POSTGRADUATE MEDICAL EDUCATION IN INDIA

PROCEEDINGS OF THE FIFTH ANNUAL CONFERENCE OF THE INDIAN ASSOCIATION FOR THE ADVANCEMENT OF MEDICAL EDUCATION HELD UNDER THE AUSPICES OF THE UNIVERSTIY OF DELHI IN 1965

Edited by

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FOREWORD

THE Fifth Annual Conference of the Indian Association for the Advancement of Medical Education, which was held under the auspices of the University of Delhi, was noteworthy in many respects. The Conference devoted its session to the discussion of Postgraduate Medical Education, a very vital subject at the present, in view of the developments in medical science and the large increase in the number of medical colleges in the State.

The success of this Conference is largely due to the untiring efforts of the Reception Committee with Dr. R. Viswanathan as the Working Chairman and Dr. A. S. Paintal as the Secretary. Dr. Viswanathan has further taken the pains to bring out this volume which contains the proceedings of the Conference on Postgraduate Medical Education. I wish to offer my very sincere thanks to him and to his colleagues for this work. I take this opportunity to thank the Chairman and other members of the Reception Committee for the great co-operation that they extended. This volume will, I am sure, be read with great interest by all those interested in the progress of medical education in this country and more particularly of postgraduate medical education.

A. L. MUDALIAR

MESSAGE

BY

DR. C. D. DESHMUKH

Vice-Chancellor, University of Delhi

I regret that illness and the need to recuperate have deprived me of the pleasure and privilege of participating in the inaugural proceedings of the Conference being held from 1st February, 1965, in Delhi by the Indian Association for the Advancement of Medical Education. This Association was started about five years ago by some very distinguished medical teachers and administrators with the broad aim of improving and advancing medical education by drawing attention to the outstanding needs as identified by observation, experience, and study. Some of these aspects are selection of students, continuous review of the curriculum so as to avoid obsolescence and give scope for innovation, improvement of the teaching and the learning processes, providing opportunities for continuing education by means of refresher, orientation courses, developing leadership, etc. The Association provides a forum where the emergent problems of medical education can be periodically discussed in an authoritative way. Annual conferences have been held regularly and important subjects discussed, such as teaching of social and preventive medicine, teaching institute of basic medical sciences and teaching institute of clinical sciences. The subject for the present conference is "Postgraduate Medical Education: the General Principles and Problems." The Association has not come a day too soon. Since the advent of Independence and planned development, there has been rapid expansion of institutions for medical education. Side by side, and as in the case of other sciences, there has been development at an extraordinary fast pace of the clinical and non-clinical medical sciences. Shortages of teachers and specialists have become conspicuous and a serious handicap. These and other problems can, therefore, be discussed with great advantage on a forum such as the Association provides, bringing together as it does both teachers and administrators.

It is very much to be hoped that medical faculties of the Universities and the authorities of the State and the Central Government concerned with medical education take serious notice of and act upon the conclusions reached in these conferences, backed as they are by the mature professional experience of academicians and administrators.

The seminal significance of postgraduate education is now beginning to be realised in all spheres of learning. It is, therefore, most appropriate that the topic selected this year should have concern with postgraduate education.

I send my greetings to the participants, together with my apologies for failing to be with them on this occasion (no doubt due to imperfect health education on my part) and my very best wishes for the success of the Conference.

INTRODUCTION

THIS volume contains all the papers and addresses presented at the Fifth Annual Conference of the Indian Association for the Advancement of Medical Education which was held in February 1965 under the auspices of the Delhi University. It also includes the *rapporteurs'* summaries as well as the recommendations of all the sub-committees. It is regretted that for several reasons it was not possible to include in the volume the discussions that took place in the meetings of the sub-committee as well as those at the plenary sessions.

It is our hope that this volume will serve as a guide to the Universities for organising medical education and as *aide-memoire* to future medical educationalists when they contemplate reorganisation of graduate training in medical sciences.

It would not be out of place here to give a brief history of the Conference. Early in 1964 the President of the Association, Sir A. L. Mudaliar, approached the University of Delhi to act as the host university for the forthcoming Fifth Annual Conference. The request was promptly accepted by the University and the Vice-Chancellor, Dr. C. D. Deshmukh, with his customary alacrity called a meeting of medical teachers and prominent medical men in Delhi to form a Reception Committee. The Vice-Chancellor was unanimously elected Chairman of the Reception Committee and Dr. R. Viswanathan, then the Dean of the Faculty of Medical Sciences in the University of Delhi, was elected Working Chairman. The other members of the Working Committee who were unanimously elected at the meeting were:

Secretary—Dr. A. S. Paintal,
Jt. Secretary—Dr. N. P. Gupta,
Treasurer—Dr. B. K. Anand.

The University Grants Commission gave a grant of Rs. 30,000 to the Delhi University to meet most of the expenses in connexion with the Conference. The US AID at the instance of their energetic Medical Adviser, Dr. Eugene P. Campbell, actively and generously assisted the Working Committee in organising the Conference in more than one way. The co-operation given by the Rockefeller Foundation, and in particular by Dr. Le Roy R. Allen, deserves special mention.

The Conference was held on the 1st, 2nd and 3rd February, 1965. Owing to the unavoidable absence of Dr. C. D Deshmukh, the task of inaugurating the Conference fell upon Dr. D. S. Kothari, Chairman, University Grants Commission. The inaugural function was presided over by Sir A. L. Mudaliar, whose stimulating address set the tone and pace for the subsequent deliberations of the Conference.

The Conference was attended by 350 delegates from twenty universities and medical colleges from different parts of India. Amongst the delegates there were also special invitees who served in various capacities in the different sub-committees.

The foreign delegates who participated in the conference were:

1. Dr. Eugene P. Campbell, US AID, New Delhi.
2. Dr. Le Roy R. Allen, Rockefeller Foundation, New Delhi.
3. Dr. John P. Hubbard, U.S.A.
4. Dr. Henry van Zile Hydge, U.S.A.
5. Dr. Howard H. Eddey, Australia.
6. Dr. Samuel A. Trufant, U.S.A.
7. Dr. Helen Taussig, U.S.A.
8. Dr. J. S. Mckim, Canada.
9. Dr. Peter A. Rechnitzer, Canada.
10. Dr. R. H. Girdwood, WHO Visiting Professor, Baroda.
11. Dr. G. L. Montgomery -do- -do-
12. Dr. W. P. Small -do- -do-
13. Dr. A. P. Kenny -do- -do-
14. Dr. K. L. Wig was nominated by the Royal College of Physicians, London, to represent that College at the Conference.

Dr. John P. Hubbard who was specially invited to the Conference by the Association gave a stimulating and thought-provoking lecture on "Whither Examinations." Similarly Dr. McLeod, Secretary, Canadian Medical Education Society, gave an informative address on Canadian Medical Education.

On the first day, after the formal inauguration of the Conference, in the morning, a symposium on General Principles of Postgraduate Medical Education was held, and on the next day the sub-committees (25 in all) deliberated and prepared their recommendations on the respective specialities. The same evening, the members of the section on Basic Sciences and Clinical Sciences met and finalised the reports of the various sub-committees. The Conference held its final plenary session on the third day, when the General Rapporteur summarised the proceedings of the Conference. It was followed by the concluding address by the President of the Association.

It is always stimulating and rewarding to organise a medical conference and some of us who had the unique privilege of being actively engaged in the organisation of the Fifth Annual Conference of the Indian Association for the Advancement of Medical Education found that the expperience gained was an education in itself. It is generally agreed that the Conference was a complete success in every way.

R. VISWANATHAN

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WELCOME ADDRESS

BY

DR. R. VISWANATHAN,
Working Chairman, Reception Committee

MR. PRESIDENT, DR. KOTHARI, LADIES AND GENTLEMEN, on behalf of the University of Delhi and on behalf of the Reception Committee, I extend to you all a very hearty welcome.

We have gathered here to discuss in a businesslike manner an extremely important aspect of medical education, namely, the training at the postgraduate level. The urgency for considering this subject in all its aspects has been created by the ever-increasing depth of the well of medical knowledge and by the inevitable impact of the widening horizons of basic sciences and technology as well as of the humanities. I have deliberately mentioned humanities as there is an unpardonable tendency to exclude humanities from the syllabus of medical education. Since medicine includes the study of human biology, man's behaviour, his impact on, and reaction to, his environment, his place in the general social order, and his contribution to the evolution and historical development of humanity in general, it is necessary that humanities should hold a prominent place in medical education at all levels.

Specialisation is the inevitable result of the extension and deepening of medical knowledge. Today postgraduate medical education has become more or less synonymous with specialisation in an organ or a disease. In our enthusiasm for specialisation we forget the human being and gather erroneous impressions like those of the blind men in Hindu logic who tried to define an elephant by the character of each of its limbs. This takes us directly to the fundamental philosophy of postgraduate medicine. Does specialisation mean exclusion of the higher learning of general human biology? In other words, can anyone specialise in kidney disease without doing advanced studies in general medicine? Can specialisation in cardiac surgery be undertaken without adequate knowledge of general surgery? Is it not desirable to build a higher common basis and lay a more firm foundation before special structures are built? Should not the specialist be primarily a sound general physician or surgeon? If this is conceded, our attitude to postgraduate training and assessment should undergo radical reorientation.

An important problem which this Conference can justifiably consider is whether specialisation cannot be undertaken as an in-service programme of apprenticeship under a recognised specialist, after a candidate has had the opportunity to raise the foundation of his general knowledge of medicine or surgery by undergoing a prescribed course of postgraduate training. His knowledge should be assessed by a university examination on the basis of which he is awarded a postgraduate degree like M.D. Only after this would he be allowed to undergo apprenticeship in a speciality. A national speciality board can be authorised to assess his knowledge and certify him as a specialist.

Fifth Annual Conference of the Indian Association for the Advancement of Medical Education, Delhi, 1965

INAUGURAL ADDRESS

BY

DR. D. S. KOTHARI

Chairman

University Grants Commission

IT is an honour and a privilege to participate in the opening function of this conference. I address it with considerable hesitation as I have no special knowledge or competence as regards the many important problems this conference is going to consider.

A revolution in science and technology has occurred during the last few decades. Great advances have been made in our knowledge of the basic sciences, such as biology, physics, biophysics and biochemistry. So also, tremendous strides have been made in technology. The developments in basic science and technology have made a great impact on medical science. Progress in medical science often depends on advancements of fundamental scientific knowledge; and, in a sense, medical science is tending towards a fusion of science and technology and the healing arts. For example, our understanding of the causation of cancer may depend ultimately on the progress in the field of cell biology which, in its turn, may depend on advances in physics, chemistry, genetics and other sciences.

The current explosion in knowledge has created many new problems for learners, as also for teachers. The doubling period of science and technology is, as now well recognised, something like ten years. So rapid is the rate of progress of knowledge and discovery that very often a medical graduate is almost obsolescent on the day of his graduation. In the modern world, education has to be a continuing process throughout one's life, as it were. Professional men need continuing revision and renewal of their knowledge and skills. It is important that medical institutions encourage this process and provide facilities for the purpose.

In a rapidly changing world, changing almost beyond recognition in a life-time, education has acquired a new role and a new meaning. Primarily, it must be education which promotes and develops openness of mind, tolerance, co-operation and ability to adjust to change. Above all, it should encourage a vigorous and relentless pursuit of truth and free enquiry. There is an urgent need for study and research, as regards the techniques of teaching and learning, contents of curricula, and the linking of what is learnt in a college with the real needs of the community and the world of work. Experimentation and innovation in education, and specially in medical education, needs to be vigorously encouraged. It is unfortunately true that very often progress in education is held down because of tradition and inertia.

The world of science is, in a sense, a "one-world." There should be much more free flow of knowledge between our country and others, specially those which hold a high place in scientific development and progress. It would be a great advantage if a proportion of the postgraduate medical students, and specially those who go in for teaching and research, acquired a reasonable proficiency in Russian and other "world languages" to enable them to keep in touch with current developments in the non-English speaking world.

The resources available for medical education, and specially the number of gifted men, are very limited. At the present stage of development of medical education in the country, it may be advisable in the case of certain fields of study and research to concentrate effort and activities in a few carefully selected places. These would serve as "breeders," seeding nuclei, in the years to come for organising more centres of excellence. Dissipation of resources, often inevitable if these are spread too thinly, should be avoided. It has been sometime suggested that with a view to improving standards of education it may be desirable to organise specialised courses (which besides subject studies and recent advances would also include elements of pedagogy) of one or two years' duration for those selected for teaching posts in medical colleges.

It is also important that conditions of work, as also of service, for the staff in medical institutions are on the general lines of what they are in good and progressive universities. In the recruitment of staff, the professional medical men should have a determining voice. It is most important that everything possible should be done to generate a climate conducive to serious, sustained and dedicated work. It would be advantageous if funds for medical education were made available to the universities through an agency somewhat on the lines of the UGC. The proposed organisation could be a part of the UGC or an independent organisation functioning in close collaboration with the UGC. This is a matter which needs, I think, serious consideration by the agencies concerned in this matter.

The chief aim of education and science in India, including medical education, should be to eradicate ignorance, poverty and disease, and to function as a powerful instrument to bring about a social and economic transformation, so that millions in our land could live happier, longer and purposeful lives.

I wish the Conference all success.

PRESIDENTIAL ADDRESS

BY

DR A LAKSHMANASWAMI MUDALIAR

President of the Association and Vice-Chancellor of the University of Madras

CHAIRMAN OF THE RECEPTION COMMITTEE, CHAIRMAN OF THE UNIVERSITY GRANTS COMMISSION, AND FRIENDS, Let me express, on behalf of the Indian Association for the Advancement of Medical Education, our sincere and grateful thanks to the authorities of the University of Delhi for having invited us to hold this, the Fifth Session, under the auspices of this famous university

I am glad to welcome Dr D S Kothari, the Chairman of the University Grants Commission who is a distinguished scientist of international repute His presence on this platform and the interest he has taken in the scientific aspects of medical education augurs well I feel sure that, in the years to come, medical education will receive at the hands of the Chairman and his colleagues in the University Grants Commission the same kindly attention that technical, technological, and scientific education has received in the past Let me convey to him our sincere thanks for inaugurating this conference

It is also my pleasant duty to welcome all of you and in particular the distinguished visitors who have come from abroad—to them we are particularly grateful—and I welcome old friends who have taken the trouble to come all the way to encourage us, to advise us, and to give us the benefit of their wide experience I am particularly happy that my old and esteemed friend, Dr Van Zile Hyde, is here today His services to the World Health Organization cannot be easily recounted and his solid contributions, both as a member of the Executive Board of the W H O and as a distinguished delegate for many conferences, have been greatly appreciated He has played a notable part in the public health activities of the United States and he now represents the Association of American Medical Colleges

It is also my privilege to welcome the distinguished physicians and surgeons from the United States, Canada, Australia and the United Kingdom, the W H O Visiting Professors now in India, and representatives of the Regional Office of W H O

This is the Fifth Annual Session of the Indian Association for the Advancement of Medical Education From time to time, the Association has taken up a particular aspect of medical education at its annual conferences and attempted to deal with all problems connected with it At the inaugural session of the Association, which was held in Hyderabad, the general lines of the activities of the Association were discussed At the other annual sessions the subjects discussed were Social and Preventive Medicine (Baroda session) Undergraduate Medical Education—Basic Sciences (Calcutta session), Undergraduate Medical Education—Clinical Sciences (Madras session)

Today we propose to deal with the very important subject of Postgraduate Medical Education and Research, a subject which must attract our attention, because on postgraduate medical education and research depends the future of medicine in this country as in all other countries.

Within the past fifty years, postgraduate medical education has developed rapidly. With new discoveries, new techniques and new methods of accurate diagnosis, medicine is no longer a question of blindly following a method of treatment. Medicine has become a more exact science, because it has profited from discoveries made in all related sciences.

II

GENERAL PRINCIPLES OF POSTGRADUATE MEDICAL EDUCATION

RESEARCH AS A PART OF POSTGRADUATE TEACHING PROGRAMME

PROF. P. N. WAHI, M.D., F.R.C.P. (LOND.), F.C. PATH. (LOND.), F.A.M.S., F.N.I.
Principal and Head of the Department of Pathology, Medical College, Agra

ONE of the criticisms against our system of medical education is that it does not equip the graduate for the three important functions he may be required to perform: (1) teaching of medicine, (2) medical research, and (3) patient-care, which would at the postgraduate level mean specialised treatment. Today a physician, be he a general practitioner or a specialist, makes use of intricate investigative procedures and complicated chemical preparations. Qualitative biophysical and biochemical findings do not satisfy him any more. Nowadays, he employs quantitative analyses. Therefore he needs more and more the co-operation of non-medical scientists, e.g. chemists, mathematicians, zoologists, and sociologists. This would require a wide-based theoretical knowledge and understanding, not only in the sphere of biological sciences but also in pure sciences and social sciences.

Thus, the existing postgraduate teaching programme in most of our institutions today cannot meet this new challenge of rapidly expanding knowledge. It is necessary therefore that the whole concept of medical education should be reorientated towards production of a doctor who will continue to contribute to medicine as an art, who will be actively interested in the programme of medical research, and who will be able to tackle successfully ever-arising problems in medicine. In other words, his intellectual equipment should be such that he can approach problems in the manner of a scientist and research scholar requiring a spirit of critical evaluation. This involves considerable independence of thought, habit of logical thinking, sense of responsibility, and initiative, besides a sound knowledge of the subject-matter involved.

To achieve this objective, our concept of teaching methods, both theoretical and laboratory teaching, will need complete overhauling. The present medical curriculum of set lectures, demonstrations, ward clinics, etc. will have to be replaced to a large extent at the postgraduate level by a technique which encourages self-education. Besides such well-known methods, e.g. small group projects, conferences, seminars, tutorials, etc. in which the student is the major participant, training in research methodology and even participation in the departmental research programmes would help to achieve this objective.

This would also help to augment the research potential of the country. Today, the demand for research workers far exceeds the supply. The one single important factor contributing to this situation is the absence of an effective research programme for medical students, both undergraduates and postgraduates, which would emphasise the important role of critical reasoning and evaluation in the study of disease and management of the patient. Training in research is essential, and this can be best given by providing students with the opportunity to perform experiments. We in our institution feel strongly that to achieve the

desired result at the postgraduate level, the research training should start at the undergraduate level. We have achieved this by the introduction of experimental methods in the teaching of undergraduates and by making it possible for some of them to be incorporated in the departmental research programmes during their elective time or vacation periods.

In some of the American Medical Schools, e.g. Yale School of Medicine, student research is an integral part of the curriculum and a dissertation based on research is requirement for graduation. Arthur Ebbert Jr. of Yale conducted an interesting study to provide data relative to (*a*) possible correlations between student research and subsequent medical career and (*b*) the medical graduate's retrospective opinion of research as a requirement in the medical curriculum. The results were revealing. "Graduates in full-time academic positions began their research earlier in the medical school years more frequently than those in private practice. 37 per cent of the total group, and 63 per cent of those in full-time faculty position, indicated some influence on the part of their student research in selection of their ultimate medical careers. 83 per cent of the graduates felt that preparation of a thesis based on research helped subsequently in evaluation of the medical literature; 98 per cent of the graduates were in favour of research, required or elective, as part of the medical curricula; and 60 per cent recommended that a thesis based on research be required of all students. In this regard there were no significant differences in the recommendations of those in private practice and full-time academic positions." From these findings, it is worth while considering the usefulness of incorporating research in the reorientated medical curriculum of the Indian medical colleges.

The question often asked is: should such a special training and attention be imparted to only those students who show a propensity and definite ability for research or can this research concept be developed in students as a category, making it obligatory for the acquisition of the postgraduate degree?

I am of the opinion that training in research methodology and engagement in a research project should be obligatory for the award of a postgraduate degree specially the M.D. and M.S. degrees. The results should be embodied in the form of a thesis, or dissertation, and this should be a compulsory part of the examination in addition to theoretical, practical and clinical examinations. Needless to say, Ph.D. and D.Sc. degrees, being purely research degrees, will require a high standard of research achievement.

How can this research concept be developed in postgraduate students? If it is accepted that to conform to all the rapidly developing scientific advances the physician of tomorrow will require a different type of approach to his studies from the traditional curricula and technics of medical schools—which outline the main objective as absorption of terminology and acquisition of knowledge and memorising of endless data—then today's education should aim at an education which would emphasise the important role of critical evaluation of the investigative data, and an intelligent application of the knowledge so gained to the management of the patient. His training should help him to cope with the dual task of acquisition of knowledge and development of judgement. He should apply his knowledge to solve the complex problems always arising around the different facets of the patient-care programme.

This emphasis on the important role of critical evaluation in the study of disease should be

incorporated in the undergraduate curriculum. It should help the student to develop an open mind to grasp the truth from whatever source it may come. Such an attitude in an undergraduate can be developed by (1) introduction of experimental methods in training, (2) provision of elective time to enable him to partake in research projects, and (3) incorporation in the departmental research programmes.

I would not go further into details of the methodology, as this would be the subject of another paper, but I would add that graduates expused to such a training in their undergraduate curriculum are more likely to accept the concept of research at the postgraduate level. A strict eye on the selection of students for postgraduate education would further help to develop such a training programme.

At the postgraduate level, research should be obligatory and the results should be presented in the form of a thesis or dissertation. Here I should ,like you to consider whether it would not be advisable to permit a student to devote himself exclusively to thesis work, which he might submit either before or after the theory and practical examinations.

One of the important deterrents to the success of such a programme is the lack of training facilities. Mere allotment of a subject for experimentation without giving him an opportunity to familiarise himself with the basic knowledge is likely to introduce ill-introduced, incorrectly analysed data leading to completely unsound conclusions. The training programme should include use, evaluation and criticism of scientific literature, compilation of bibliography and above all the competent use of libraries. He should be taught the correct method of maintaining record of the literature and his observations. He should be familiar with the use of international code which could be used in statistical analysis of his results. The training in statistics and its use should be an integral part of a research student's equipment. Special courses either organised by the basic departments or the departments of mathematics and statistics of a science college should be a regular feature of a postgraduate's training to enable him to acquire a working knowledge of elementary statistical principles and methods.

It would be desirable that postgraduate education should be imparted on a whole-time basis so that the students could be incorporated in the departmental research programmes. In case of in-service training programme, the students could participate in the departmental research programme during vacation.

The creation of the right concept for research and the provision on effective facilities will ultimately depend upon the research orientation of the staff, the facilities in the institution, e.g well-equipped and staffed divisions of experimental medicine, and research programmes of the department. However, the research activities of the students can be augmented by the organisation of research conferences and meetings. Furthermore, the postgraduates should be encouraged to participate in the national and international conferences. The selected students should be encouraged to move for shorter and longer periods to other institutions where problems on which they are working are more fully developed. Research work should be given due recognition in the form of publications, or prizes may be awarded to junior workers.

In the U.S.S.R. there is a student research association managed by students with the technical guidance of their teachers in every postgraduate institute. These associations

organise inter-school research conferences and the annual *All Union Conferences on Students'* Research. This would be a useful pattern and it could be adopted in this country. In the U.S., *students' research programmes* have been *given great impetus in recent years*, and a thesis based on original enquiry is a must for an M.D. degree. In the U.K., departments of experimental pathology have been organised in many a school.

At this session, we hope to discuss Postgraduate Medical Education in all its aspects and the significant role it has to play in the promotion of research. A former Vice-President of the Royal College of Surgeons of England, speaking at the London meeting of the International Federation of Surgical Colleges, stated: "A Fellowship of the College did not mean that a man was a trained surgeon. It merely indicated that the trainee has passed the examination. The Fellowship should be regarded as an intermediate test of knowledge and not as the hall-mark of a fully trained and experienced surgeon."

I should like to emphasise this important statement because at present it is generally believed that if a person obtains a postgraduate qualification, he can thereafter be considered as a specialist in the particular subject. In many countries, such as Germany, it takes years after obtaining a postgraduate qualification before the person concerned can be recognised as a specialist.

Another important aspect which I would request my colleagues to consider is that a training centre for postgraduates is quite different from a centre where patients may be treated. A perusal, for instance, of the institutions well recognised in the United States for certain branches of study and treatment will make this position obvious. Many hospitals may have facilities for treatment of patients in certain of the special branches of surgery or medicine but few of them are recognised as centres for postgraduate training and research because for the latter we require a much more elaborate and well-conceived plan to enable a scientific method of training to be given for postgraduates and research workers.

A single swallow does not make a summer; nor can a well-trained surgeon or physician in a particular speciality be considered sufficient for training postgraduates and research workers in that speciality. At present, there is a tendency for colleges to vie with each other in starting departments of postgraduate study with inadequate facilities, with the teaching personnel insufficient in number as well as in experience, and with very little of the necessary technical and technological equipment available for proper training of candidates. If the level of postgraduate instruction is to be improved, the institutions recognised for postgraduate instruction must meet higher standards. It is suggested that recognised international standards be adopted in India.

Sometimes, even before undergraduate courses are fully established and a college is recognised as an undergraduate study centre, attempts are made to open postgraduate studies because a well-experienced professor is available. This is not sufficient for the training of postgraduates.

Certain facilities ought to be available for the number of postgraduates that are admitted into any branch of study in an institution. While it is not contemplated that postgraduates will have to be given didactic lectures and methods of instruction more suitable at a lower level, it has to be clearly realised that the number of students admitted for post-

graduate study must he limited to the facilities availahle, if proper attention is to he given to them aod if they are to get proper facilities tn wnrk on their nwn aod to atteod seminars and to have opportunities for a wide range of clinical experience.

Many postgraduates will ultimately settle down in teaching institutions. It is good that they do so, for there is no place where a mnre stimulating atmosphere cao he obtained for their future study and imprnvement fnr research. From the point of view of enabling them to discharge their duties at a later stage, therefore, it is desirahle for postgraduates to have npportunities to he understudies to professors when they are dealing with undergraduate students and tn have npportuoities to shnw their wnrth as demonstrators nr lecturers in the special suhjects concerned.

Medicine is hoth a science and an art; and in modern times discoveries in many other fields nf science have a large hearing on the prngress nf medical discoveries. One of the most essential requirements in a department teaching postgraduates is the complicated techoological equipment needed fnr research purpnses. No lnoger can it be said that an electron microscope is a luxury, for in many fields nf microhinlogy and related suhjects, it has hecome a necessity. Fnr every person whn is dning research, a computer may be equally necessary.

If maoy new ideas in regard tn medical and surgical specialities are tn be implemented, it is necessary to have close cn-operatino with the sister prnfessinn nf engineering. Electronic devices are the nrder nf the day in advanced fields nf research aod treatment aod shnuld he incnrporated ioto teachiog departments. The subject nf hio-medical electrnnics is hecoming more and mnre important, aod I hope that snme of nur medical colleagues will he trained in this field nnt nnly tn assist in setting up many of these complicated instruments in wnrking order hut alsn to undertake research and contrihute tn the development of surgical skills and procedure.

Let me refer finally tn noe important profession whnse contrihution, I regret tn say, is not as well appreciated as it nnght to be. I refer to the nursiog profession. The great role that nurses can play is ahundantly recngnised and yet it has not heen possihle for us to take due note of the training that the nurses have tn get if they are to play their part efficiently, with success, and with increased honour tn the profession. It is for this reasnn that, at this session, a special section is devoted to the oursiog profession. Whether in the operation theatres nr in the post-operative wards or in any other fields of nursing, the part that can he played hy a nurse trained in the specialities cannot he exaggerated. Yet, by and large, we have not assisted nur sisters of the nursing professinn in getting training in some of the higher specialities of medicine and surgery. I hope, as a result of the special session for nursing at this conference, a stimulus will he given for nurses tn specialise in nursing in such fields as neuro-surgery, plastic surgery, and cardinlogy, particularly in the operation-theatre techniques which are becoming more and more elahorate with each specialised hranch of surgery.

It is my hope that schools of nnrsing that are now available in the country will be developed along these lines and the universities will come to recognise the importance of giving them adequate recognition for their special qualifications hy institution of diplomas or degrees. I hope also that more schools of nursing of higher grade will be established in the country and that nursing will come to its own in this couotry as in other countries.

Ladies and gentlemen, before I conclude, let me express my grateful thanks to the organisers of this conference and in particular to the Chairman and members of the Reception Committee and to the authorities of the University of Delhi who have spared no pains to make our stay both comfortable and profitable. To the distinguished visitors who have come from abroad, I once more extend a cordial welcome. No profession lends itself to international contacts more readily than the profession of medicine, and I am glad, therefore, that our visitors from abroad have graced this occasion with their presence.

Among the postgraduates, there will be outstanding students who, if encouraged and rightly guided, can make effective contribution to research and ultimately adopt research as a career. These outstanding students should be encouraged to carry on research in laboratories outside their own colleges. One could go to the extent of allowing a student with special research aptitude to intercept his normal study for a period of one to two years to enable him to follow his research study. This would also include the community research programmes which may be carried out as field projects outside the laboratories.

I think it would be a correct appraisal of the situation in this country if I say that, by and large, there is a unanimity of opinion that the introduction of exercises and problems of research into student curriculum would be beneficial for the reasons given earlier. However, there are some serious difficulties which have so far hampered the progress in this direction.

Introduction of student research into the curriculum either as a routine activity or as an extra study limited to a few requires teachers who are interested in research and who have plenty of time at their disposal to be able to carry on research work themselves as well as among the students. This is only possible if the staff is whole-time and well paid. Indulgence in private practice by teachers of the medical colleges is the greatest deterrent to such a programme in this country.

Another point that is often made against the successful introduction of such a programme is the inadequate knowledge in basic sciences, e.g. biochemistry, biophysics and biostatistics. It would be worth while considering if the postgraduates should not be required to work in the basic departments for at least six months as whole-time attachments, before undertaking a research project for their thesis.

Lack of financial support for students' research further hinders such a programme, even if there is recognition of its utility. A proportion of undergraduate students have to support their wives and families by outside work and, therefore, they are unable to participate fully. Sometimes they have to combine hospital service with postgraduation, with the result that the service-load leaves little time and energy for any creditable original work.

The research worker in this country is not given either security or status. Most of the institutions have no whole-time job for research workers and even where these exist, they are in the form of research scholarships of small amounts tenable for one or two years. Research experience is not given an equal status with teaching experience for selection to the college faculty and, consequently, an outstanding research worker cannot become a teacher because he has no teaching experience. It is high time the medical educationalists and selection bodies realised that research is necessary for effective teaching—and an appraisal of

a candidate for a teaching post should be based either on his research contributions or on teaching experience or both.

The introduction of a research-bias in postgraduate education is likely to play an important part in all fields of medical education, including teaching, research, general and specialist practice. It would help to emphasise that medicine is a life-long study. In our country with acute shortage of doctors, research work as a part of training of a postgraduate may further help in solving some of the urgent problems of public health by active participation in health education programmes and supervised preventive and curative services.

All my remarks may well be considered as applying to medicine of tomorrow. I hesitate to prophesy tomorrow's needs of medical practice and the requisites of a doctor who will be accepted by the society as competent, because all prophecies, as a French journalist pointed out, are either obvious or wrong. However, I could assert that what I have indicated is more obvious than wrong. The crucial element will always be a "good doctor." But who is a good doctor? The answer would depend on the time and society to which he belongs. Be that as it might, we must remember that today's good medicine was yesterday's research and today's research will decide what will be good medicine tomorrow.

THE POSTGRADUATE STUDENT

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THE study of medicine is a continuous process in the life of a physician and therefore the so-called "postgraduate study" is only another milestone in the whole process of learning. However, the term "postgraduate student" conventionally denotes that part of a physician's career where he equips himself for a specialised branch of medicine. This is one phase when he identifies himself with his speciality and makes life-long friendship with it.

The image of the postgraduate student is usually seen only through the eyes of the medical educator or the teacher. It is important to look at this "postgraduate student" through the eyes of the student as well. The medical educator sees the postgraduate student with reference to his academic ability and aptitude. Therefore, he divides the postgraduate students into three groups:

1. The first group is the academically brilliant students who from the beginning have set their eyes on a speciality not only from the point of view of earning a livelihood, bettering their social and professional status but also from that of the pursuit of knowledge. They enrich their speciality by their original contribution. They fulfil the criteria conventionally laid down for a postgraduate student. They live and breathe the speciality, nurture and foster it. They are the type of students who, with proper guidance, would make a contribution in the field of medicine.

2. The second group is made up of the above-average students who are ambitious to take up a speciality. These students by their hard work manage to attain a reasonable standard and then they are able to make a contribution to the practice of medicine.

These students are not academically as brilliant as the first group, but they can acquire with perseverance the required knowledge and technical skill. The quality of the training and the type of instruction imparted to them would be of importance. The proper type of training and instruction would make them successful in the end. Some of them do outstandingly well. Such students, even though they may fail in their first attempt at the postgraduate examination, are sure to "make the grade" eventually and become successful specialists.

3. The third group of students who form the majority of candidates, as can be seen from the present-day applications for postgraduate studies, have neither the aptitude nor the ability for specialisation. Their motivation for specialisation stems from the desire to better their professional status in order to acquire the ability to make more money. It is very unfortunate that in India degrees rather than training determine the stature of a medical man. Obviously, these candidates are unsuited for the present system of postgraduate specialisation. Yet after hard work they may get a postgraduate degree like M.D. or M.S. and still continue in general practice. These candidates would make good general practitioners provided ade-

quate training is given in the management and care of patients. Such general practitioners can refer complicated cases to the specialist. In India, there is no special training or qualification given to those medical men who could continue as effective general practitioners. The universities have concentrated their attention mostly on the academically bright students, but the majority of the students fall into the third group. The students of this group are those who deal with the majority of patients on a general practitioner's level. It is therefore necessary to orient our postgraduate training so as to make provision for further training, particularly on the practical basis, for this group of medical men.

The problem, when viewed by the postgraduate students is entirely different. The academically brilliant students seize every opportunity to gain a postgraduate degree and they have no difficulty in being selected for the postgraduate course. In fact, they are wanted by their teachers to specialise in whatever field of medicine they are interested and they are also offered financial assistance through formal jobs or fellowships. But the moderately good students may find some difficulty at the postgraduate selection. However, for them, the problem of being selected may not be as difficult as to find financial support for prolonged postgraduate studies. These students usually need one or two additional years for this course. A large number of medical graduates who apply for postgraduate studies are motivated by the fact that they attain a higher social status and gain financial remuneration with postgraduate degrees. However, they may not have the intellectual capacity or aptitude for such postgraduate courses. They would prefer to be general practitioners but there is no postgraduate course designed for such a specialisation. If adequate general practitioner type of courses and qualifications can be given, this group of medical graduates would be greatly benefited. Not only are they benefited but also the public who can get the services of well qualified general practitioners.

The problem that the postgraduate students of the third category face is one of real and practical difficulty. The entire medical course extends over six to seven years during which time the parents have to struggle to support these students. They cannot get financial assistance as they are not academically brilliant. Education in any other field would have gained them an appointment or made it possible for them to realise a fairly comfortable living, while in the medical field, they would be just then contemplating postgraduate studies. It is at this age that most of the students contemplate marriage, and take on more responsibility for the support of the family. Thus, the medical graduate is faced with the alternative of getting married or taking up postgraduate studies.

Often in most of the universities and institutions there is no provision for financial assistance for the average student. If the situation is to improve, adequate financial support will have to be given to this group of postgraduate students. Moreover, it must be remembered that for adequate postgraduate training each candidate will have to take full-time responsibility for patient care. Merely being a postgraduate student will not give adequate experience and responsibility in handling the patients in their specialities. Such a situation demands adequate remuneration for the postgraduate student.

There is yet another problem the young medical graduate faces when he is contemplating his future. He knows he is not a brilliant student. He had failed once or twice in one

or two subjects, and had lost six months to one year in the undergraduate course. He wants to get married and settle down, yet he is prepared to struggle for a few more years to better his prospects. So he tries to acquire a postgraduate degree which he can get easily and in the shortest time possible. He is not interested in a good training as much as a degree which can ensure a better appointment. The young medical graduate of today is confused and worried as to what he should do.

The majority of medical graduates who are suitable for general practice and without the ability for higher studies and specialisation find that there is no provision for postgraduate work in their field of choice. Nor have they any opportunity to get financial support to work in various fields in order to familiarise themselves with the work that general practice involves. Even if they decide to take postgraduate course in some field, they find no uniformity in the course or training. And even after getting such a degree they turn back to general practice, for which they are in no way better prepared.

It is therefore necessary to reorient the postgraduate training of our students. The following points may be considered:

1. Adequate remuneration for the postgraduate students to work full time in departments of their specialisation.

2. Organisation of postgraduate general practitioners' courses covering two or three years; conferring of diplomas or degrees. Thus, it will be possible to give more opportunities to the academically brilliant students and to bring about a better standard of general practice for the care of the sick.

3. Uniformity in the postgraduate qualification and training.

THE POSTGRADUATE TEACHER

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"TO be a well-favoured man is the gift of fortune, but to write and read comes by nature," so wrote Shakespeare. Are we justified in adding "to teach comes by nature"? If the capacity to teach is essentially a natural phenomenon, dependent on genetic configuration of DNA and RNA, there will be no need to consider the subject "postgraduate teacher" at all from any angle. It is because certain qualities and requirements are measurable by virtue of their being acquired that the subject has been included for consideration. I am, however, convinced that expressions like "gifted teacher" and "born teacher" are not wholly unjustifiable. There are certain undefinable qualities incapable of being assessed by any kind of known yardsticks, which characterise an ideal teacher, and which makes him, partly at least, a product of nature.

Is the postgraduate teacher different from the undergraduate teacher or from the school teacher in any way? Teachers of all categories attempt to expand the horizon of knowledge, in other words, reduce the quantum of ignorance of the pupils they profess to teach. Hence, the objective of every teacher is the same, be he a primary school teacher or a university professor. The two fundamental differences, however, are the subject he is teaching and the students he is dealing with. The mode of transference of knowledge from the teacher to the taught does not materially differ excepting for the fact that the postgraduate student, being adult, will not tolerate being treated as a juvenile. The postgraduate teacher has to help the students to discover themselves in the world of knowledge. His position is complicated in that he should see that his authoritative position is acknowledged and recognised, and at the same time he has to treat his students as persons with integrity and freedom of choice. The good teacher's greatest responsibilities and greatest skill lie not so much in his love for the subject nor in the clarity of his exposition, but in his ability to overcome resistance on the part of the students. Resistance to listen and to learn is present in every school-going child to varying degrees depending on the degree of parental imposition of totems and taboos during infancy and childhood. The knack of overcoming resistance and establishing an undisturbed and unobstructed channel of communication with the student are qualities which teachers of all categories should possess. Since a good secondary school teacher has learnt such qualities the hard way, the postgraduate teacher can perhaps benefit by having sessions with a school teacher in the art of overcoming the resistance of the student. Since such a suggestion is likely to bring about resistance from the postgraduate teacher who will naturally resent any kind of commerce with a school teacher, a more acceptable proposition will be to prescribe a short-term orientation course in a teachers' college for all prospective teachers of medical science. This will do both the undergraduate and postgraduate medical teachers a world of good. Such teaching will prevent teachers talking through the hat and talking over the heads of

miserable and pitiable students who find to their dismay the boundaries of their ignorance rather than their knowledge expanding every day.

It is because the training of medical teachers in the art and science of teaching has been completely neglected so far that I have introduced the problem in this lopsided manner.

Having started in an unorthodox manner, I shall continue in a heterodox way and say something about "words," as they are the most important tools we use in lectures, in conferences, in discussions and even in ward rounds. Whether it is on the pulpit or the platform, whether it is at the bedside or in the postmortem room, whether it is in the clinical or in the laboratory demonstration, the teachers' knowledge, comprehension and understanding can be communicated to the students only through words. The degree to and exactness with which it is done will measure the effectiveness of a teacher. In this process, words are the essence. "They can result in understanding or misunderstanding, they can arouse antagonism or *co-operation, discouragement or enthusiasm*, apathy or *activity*: *they can lead to retrogression* or progress."

Closely connected with the right use of words is the controversy about lectures versus clinics and demonstrations. Whether a lecture or a demonstration you cannot do without words, since they are the only medium of communication between the teacher and the student, either for transmitting his knowledge during lectures, or interpretation during clinics, or observations during demonstrations. What words to use, when to use them, and how to use them, are matters which have received the least consideration in the training of a medical teacher. The effective power of the voice cannot be equalled by any instrument. Through the spoken word the factual matter gains vividness and thus an interpretation commands responsive attention.

forty books is scholarship !

The organisation of a good lecture consists in the preparation of proper outline, use of ancillary aids, such as the blackboard and lantern slides, and the timing.

The most neglected aspect of medical lectures is delivery. For successful delivery there should be proper concentration and smooth, uncomplicated labour. Since the voice is the tool, it requires proper cultivation. It is needless to point out that mannerisms like putting the hand in front of the mouth while speaking, looking down at an imaginary listener under the desk instead of looking straight into the eye of the audience, or walking back and forth and side to side like a caged lion should be avoided.

The art of teaching is a technique just as cooking is a technique and an art. Both are also sciences, in that both are to be systematised and organised. It can easily be learnt by experience and observation.

I have dealt with the subject of lecture at some length because I am of the view that learning the art of lecturing and other aspects of teaching should be insisted upon before a medical man or woman is appointed as a teacher. Special training should be provided for. In some of the European countries the title of professor is conferred only if the candidate passes a practical examination in lecturing.

Let me now pass on to the more orthodox aspects of the subject, the postgraduate teacher.

The qualities which a postgraduate medical teacher should possess will depend on what he is expected to do. In other words, we must know what are the objectives of postgraduate education. Concerning higher education in general, there are two points of view found in all critiques of teaching. One regards teaching as stuffing or translocation of factual matter, from the stuffer, the teacher, to the stuffed, the student. "The other view is the 'make them think' or voltaic pile interpretation which regards teaching as applying suitable chemical to the inactive zinc and copper component of the student so that he may become a producer of current or fountain of new knowledge. The postgraduate teacher will have to utilise both courses, so that the student is not only provided with the material but is also enabled to catalyse his process of assimilation, discrimination, rejection, elaboration, and ultimate synthesis. The raw material given to him by the teacher is not only stored but transformed to form an integral part of his make-up."

The University Education Commission has summarised the aims and objects of university teaching as follows:

1. Transmission of the intellectual and ethical heritage of humanity to the young.
2. Enrichment of this heritage and extension of the boundaries of knowledge.
3. Development of personality.

These are noble objects but hardly understood, and rarely followed. All the same, they constitute the teacher's testament of faith, noble ideals worth striving for.

Are these objectives relevant to the postgraduate medical teacher? I should say, yes. The aim of medical education, in general, and postgraduate education, in particular, is not only to stuff the student with available medical knowledge but also to promote the development of the student's personality by stimulating in him the spirit of enquiry and criticism so that his mind can acquire the habit of exercising independent and unbiassed judgement.

The only way by which a teacher can impress the student to creative activity and independent judgement is by being himself engaged in scientific pursuits. He must contribute to the expanding horizon of medical knowledge. Research should not merely be a casual activity of the teacher. *It must constitute the essential part of his function* and may be neglected only at the peril of intellectual stagnation. There is no conflict between teaching and research, each is complementary to the other. Research keeps a subject alive. The teacher should not only be working on the frontiers, where new ideas are formulated and new discoveries are made, but also share the exciting adventure of exploring new horizons. Advanced instructions cannot be separated from the active pursuit of knowledge. The individual who assumes responsibility to train postgraduates should at once be a teacher and a productive scholar.

Scholarship, research and teaching ability are the criteria on which the suitability of a candidate for the post of postgraduate teacher should be assessed.

The teachers in medicine and in other disciplines of the university are ordinarily categorised into professors, readers, and lecturers according to their seniority, scholarship, standing, and experience. The postgraduate professor should have sound scholarship, research experience and teaching ability of a high order. He should have participated in the training programme of postgraduates for a number of years. He should have acquired a reputation for scholarship and research. He should not merely be a specialist but should have wide interests and broad outlook. He should inspire and stimulate his colleagues to scientific activity. In short, he should be a model for others to emulate.

A Reader must be a man of learning and research and should have laid the foundation of sound scholarship.

The Lecturer should have a brilliant academic record. He should have done some teaching and should evince keenness and aptitude for research.

In laying down the above requirements for postgraduate teachers, I am, it may be pointed out, like Oliver Twist, asking for more and opening my mouth too wide. But can one deny that such high standards for postgraduate teachers are necessary for the training of future teachers and specialists in the country?

MODE OF SELECTION

How are we to select the teachers? What yardsticks should we use and in what manner and by whom should those yardsticks be used?

The Indian Medical Council, the Universities, and more recently the Mudaliar Committee, have spelt out the requirements for various categories of teachers in medical colleges. But for some minor differences, the qualifications prescribed are more or less the same. The scholarship of the candidate is determined by the postgraduate qualification and the academic career. Research experience is gauged by the number of original papers published. Years of service as a teacher will no doubt give the information about his teaching experience.

Selections are normally made by the Public Service Commissions or Selection Committees of the Universities who are expected to be, and in many cases are, impartial tribunals assessing candidates with discrimination and judgement. In all cases, interviews are insisted

upon. Properly conducted, the interview will constitute an indispensable adjunct to the difficult process of assessment. Ordinarily, the candidates live up to the specifications mentioned in their applications. In the majority of cases, the academic career, length of teaching experience, postgraduate degrees, qualifications, and original publications will provide adequate evidence regarding his suitability for the post. An intelligently conducted interview will sometimes facilitate the screening out of those who are not what they seem on paper.

There is a trend today for the Service Commissions to lean heavily on expert advisers who, more often than not, conduct a stiff viva voce examination asking sometimes irrelevant questions, the answers to which, by no stretch of imagination, will reveal the real merit and suitability of the candidate for the teaching post for which he is being interviewed. I have often seen experts meticulously marking each answer given by the candidate. Since performance at the interview often constitutes the sole criterion for selection, some of the best candidates occasionally get rejected and those of average ability get selected by virtue of their having answered all the questions and having thereby got the highest marks from the over-conscientious expert adviser to the Commission.

Interviews ought to be used not so much to assess the candidates' scholarship as to give opportunity to them to exhibit the qualities required of a teacher and which are not capable of objective measurement by available yardsticks, such as degrees and publications. For example, one such quality is the power of expression and cogent argument. A general question can be so framed that the candidate will have to give his answer in the form of a speech for four or five minutes. Thus many other general qualities required of a teacher can be assessed in a properly conducted interview.

Considering the many odd circumstances which we have to face, it is extremely difficult to secure an objective and impartial assessment of a candidate for a teaching post. This is not my view alone. It is the view of most educationists throughout the world.

By and large, we can succeed in making proper selections provided extraneous considerations do not reverse the results of selection.

If the objectives of postgraduate medical education are to be fulfilled, the greatest care should be given to the training and selection of those who are to shoulder the heavy responsibility of carrying out the training programme. The teacher, not the material facilities, constitutes the keystone in the arch of the temple of higher learning.

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of the problem. The plan assumes that the postgraduate student should have an enquiring mind, that he should be able to assess and reject, if necessary, the seemingly established thoughts on current problems and be prepared not to tread the time-ridden, beaten tracks. The basic idea is, therefore, to inculcate in the mind of the trainee that the last word has never been said about any medical knowledge, that what passes for knowledge is often based on slippery foundations. It is expected that out of this band of numerous budding research workers on the threshold of their postgraduate careers will emerge at least a few who will accept this kind of work as their life-long avocation and thereby enrich the research potential in the country.

ADVANTAGES

If the students and trainees are considered as the backbone of a postgraduate department, the advantages and benefits of research-orientated training programme are very obvious. In the first place, they bring to the department an atmosphere of learning, of serious study and of a spirit of enquiry without which an academic department cannot flourish. Such an atmosphere is conducive to the best interests of both the teacher and the student. If a teacher should act not only as the guide of the student but also as his philosopher and friend, opportunities to know the student well and to be familiar with his problems naturally constitute an important part of this problem.

The benefits of the research-orientated study programme to a student are immense and many-sided. Instead of merely attempting to learn the facts as they are, it gives him an opportunity to contribute something new, however meagre that may be. It makes him familiar with the methods of studying existing literature on the subjects and enables him to summarise such literature and make use of it in the context of his own programme. Instead of merely reading the usual text-books, the student has the opportunity of rummaging over a vast field of world literature on the subject of his choice, thus enabling him to discover for himself the thoughts of other people on the problem. Most of all, this method of study takes the student off the beaten path, makes him think, increases and improves his faculties of imagination and reasoning. In short, it makes him a better equipped man.

DISADVANTAGES

Many views and opinions have been expressed against the research-orientated study programme. Thus it has been said that the method is unconventional, time-consuming, unproductive and, therefore, unprofitable for the average student. Many students, it is emphasised, spend their time in copying work that has already been done. What goes for research, therefore, is recapitulation of existing knowledge in a different garb and the student often acts as a second-rate copy writer rather than as an original thinker or worker. Further, in the prosecution of this kind of second-rate work, much time is needlessly lost, which could be utilised profitably in learning the art and science of his speciality. In many universities, thesis work takes precedence over adequate training programme and as a trainee the student is no better at the end of the stipulated training period than he was at the beginning.

THESIS OR DISSERTATION AS PREREQUISITE FOR POSTGRADUATE EXAMINATIONS

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THE importance of research work as an essential part of postgraduate medical education has been emphasised on many platforms and on numerous occasions. Medical research is developing at an ever-widening paee on many frontiers. There bave been more advances in medical knowledge in the last 25 years than probably in all the preceding years since the days of Hippoerates in Greece and Sushruta in India. Many of these discoveries have been made by young men in the formative years of their medical education and some even in their undergraduate days—witness, for example, the discovery of panereatic islets by Langherhans and insulin by Best. Frossman was a young postgraduate when he thought of the idea of introducing catheters in the beart, and Hunter, the Australian anatomist, described the benefits of sympathectomy while still in his twenties. Many more examples may be cited but it is enough to say that the young mind—eager to strike out new paths and ever receptive to new ideas and thoughts—is the proper field in which the benefits of research should be firmly planted.

Unfortunately, we in India, until recently, had failed completely in understanding and aeeepting the value of research work in postgraduate medical education. We were content to imbibe ideas from abroad and did not produce any which we could call our own. The bureaueratic system of medical administration in this country, in addition, left little scope and fewer opportunities to do research or any origioal work.

In many Indian universities today, ooe of the prerequisites to be eligible for the higher postgraduate examination is the preparation of a thesis embodying researeh or investigative work of some kind. However, the standards required or expected vary markedly from one university to another. Few of the universities require the candidate to do the work bimself and to show that the work has in some way "advanced the frontier of medical knowledge." Other universities would accept what they call a dissertation—meaning thereby collection of views and opinions of others embellished perhaps by a few notes or data which again are obtained from others. It seems that there has not been any revaluation of this problem and the advantages and disadvantages of tbe process have not been deliberated at length.

OBJECTIVES

What are the objectives of this plan of researcb activity and the writing of the thesis by a postgraduate student working for his degree? I am sure that the idea is not so much that every student would be able to contribute a vastly superior fund of knowledge to his subject. The aim rather is that he should sbow evidence of his activity to grapple with a particular problem in a systematised way, thereby contributing some thought in the elueidation

ROLE OF MEDICAL COLLEGE HOSPITAL IN POSTGRADUATE MEDICAL EDUCATION

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THE two terms—medical college hospital and postgraduate medical education—deserve some explanation. By medical college hospital or a teaching hospital or university hospital is meant a hospital attached to a medical college with bed strength in appropriate proportion to the yearly intake of students and which has an out-patient service, general and speciality services, up-to-date medical reference library, a sound medical record system, a reasonably high autopsy rate and other ancillary services. It means a hospital where emphasis is on teaching.

Postgraduate medical education is only an extension of the undergraduate education, the terms undergraduate and postgraduate being used only as a matter of convenience, the former indicating education leading up to qualifying examination and the latter to specialisation examination. The difference is in the degree of education and not in the kind.

Since Independence the Government of India have launched on a comprehensive health-care programme for the people. Any country launching upon such a programme has to pay adequate attention to the training of general doctors as well as to the training of specialists.

Two expert committees (Bhore and Mudaliar Committees) have closely studied the health and training programmes, and their findings reveal the gross inadequacies.

The role of a medical college hospital in postgraduate studies in the major subjects, such as medicine, surgery, obstetrics and gynaecology and their specialities, is undeniable. It is enough to say that specialised training in clinical subjects has necessarily to be imparted by allowing the aspiring postgraduate students to assume progressively increasing responsibility for professional care of the patients. This is achieved by appointing them as Resident Medical Officers. While holding the appointments of House Surgeon or House Physician, the postgraduate student examines the patients attending the hospital first as out-patients; he then arrives at a diagnosis after clinical examination as well as by use of laboratory or X-ray investigations and chalks out a plan of treatment which is supervised by his chief. In regard to patients requiring hospitalisation, he has to record their detailed histories. He arranges for laboratory and X-ray and other types of procedures. He is also concerned with the planning of treatment under the guidance of his seniors and is also responsible for execution of the regime planned. This gives him ample opportunity to study the progress of the patient at close quarters. Then he takes rounds with his seniors in wards and discusses with them various aspects of diagnosis and progress of the patient both to his knowledge and training. He attends clinical and teaching sessions, and, on occasions, is asked to teach the undergraduate students on the ward service. He has the further advantage of actively organising and participating in departmental seminars, clinical conferences, and conferences on mortality. He also attends

WHAT SHOULD BE DONE

What then are we to decide about this kind of study programme in the context of our national needs? We have to bear two things in mind. First, the country needs a large number of specialists, well trained in postgraduate work in as short a period as possible. Alacrity should, therefore, be the keynote of our training programme. Emphasis should be placed on acquiring the essential knowledge, learning the important techniques and developing judgement, confidence and independence in the performance of the allotted work.

At the same time, one need not be blind to developing the inquiring incentives in the minds of our young specialists. It is essential that while we are imparting practical knowledge to our young postgraduates, we should also try and stimulate the impetus to prosecute original work which lies dormant in the minds of most aspiring doctors. However, the subject of research study must be chosen with good deal of care. It should take up specific, well-defined problems. It should be capable of solution in one way or another within the limitations of the facilities available at a particular institute. It should not involve wastage of time at the disposal of the postgraduate and certainly it should not be done at the expense of his overall training programme. It should be carefully supervised at every stage. The temptation to take up side issues, not relevant to the problem under study, should be scrupulously avoided.

SUMMARY AND CONCLUSION

Therefore, it appears to me that although there are many arguments against introducing or retaining a programme of research study in the postgraduate training period, the balance of evidence seems to be in favour of such a research-orientated programme. The life of a postgraduate student on a given programme becomes more interesting and more enjoyable. A good student will find it a rewarding endeavour. His future progress to academic hierarchy will also be built on surer ground and many a successful research worker will look back on this formative period of his work with affectionate remembrance. Here, he would say, was time well spent in learning the methodology and techniques of research.

However, this kind of research activity of a neophyte must be supervised and it must form an important part of his overall training programme as a specialist. It must not be the basic essentials of his subject, nor in his mastering of the practical aspects of his speciality.

The research-orientated study programme is, therefore, intended to make the postgraduate student a man, not merely a technician or a craftsman.

pyelograms, splenograms, cerebral angiograms, arteriograms, lymphangiograms, etc.). The third study of anatomy in the teaching hospital is the surgical clinic and operation theatre. One lecturer in anatomy regularly attends the surgical out-patient department and examines cases from the point of view of altered anatomy. For example, a detailed study of a case of hernia with the background of the anatomy of the inguinal canal, or of cancer of tongue or breast from the point of view of lymphatic spread is very educative for applied anatomy.

PHYSIOLOGY AND BIOCHEMISTRY

There is no place like the teaching hospital for postgraduate study of these two disciplines. The study of physiology and biochemistry has so far been restricted to the departmental laboratories and animal work. The study of these subjects is not complete unless the knowledge gained is tested or applied to the conditions present in the human body. Cases of neurological, respiratory, cardiovascular, alimentary or endocrine dysfunction are studied by postgraduate students for the understanding of altered physiology. Postgraduate students of physiology regularly attend clinical sessions in the wards of the teaching hospital. They examine cases of neurological, cardiovascular and other ailments and determine the lesions and delineate the affected from the unaffected parts of the system. This gives them an insight into, and an opportunity for, testing or applying their knowledge towards diagnosis of clinical conditions existing in the patient at the teaching hospitals. Electro-encephalographic and electro-cardiographic tracing are of great importance for the study of neurophysiology and cardiovascular physiology, respectively. Respiratory physiology can be best studied in close collaboration with the department of anaesthesia as also chest surgery. The knowledge of cardiovascular physiology can be very effectively furthered by collaboration with a cardiovascular surgeon. Likewise the pre- and post-operative studies yield better results in the cardiovascular surgery department. Studies in electrolyte balance and fluid balance are best made when persons suffering from burns or from severe dehydration in clinical wards are being investigated and treated. Services of pre-department of endocrinology could be very usefully harnessed to further the knowledge about physiology of the endocrine glands.

PHARMACOLOGY

This is what we do in the pharmacology department in our college:

Basic subjects in medicine are taught in medical colleges in relation to clinical subjects. This is especially done in the subject of pharmacology. The postgraduates we train in pharmacology are what we term medical pharmacologists, i.e. pharmacologists oriented to medicine, that is, a medical man oriented to pharmacology. These teachers will also orient undergraduate students to the pharmacological basis of medicine, and so a close relation between the clinician and the pharmacologist becomes very necessary. Postgraduate students in pharmacology have to know what is being done with the use of drugs in wards, and in this field the hospital services and clinicians can contribute quite significantly. Association of the department of pharmacology with a medical unit and three to four hours per

formal lecturers arranged by the educational institutions or the university and undertakes research and investigative work under direct supervision of his chief. All these activities give the resident medical staff an excellent opportunity to obtain speciality training under expert supervision and guidance. In due course, he studies for his speciality examination and after passing it becomes a specialist. This type of training is the only way to train postgraduate students in clinical subjects.

Now let us consider the role of a teaching hospital in postgraduate education in basic sciences, such as anatomy, physiology, biochemistry and pharmacology.

ANATOMY

A student of anatomy has so far not moved out of the confines of the dissection hall, the micro-anatomy and embryology laboratory, and the museum. The chief mode of his education is (*a*) the dissection of the embalmed, hardened human cadaver, (*b*) the study of the macerated dried bones, (*c*) the study of dissected preserved parts, and (*d*) the study of the various transverse or oblique sections of the human body. I suggested a deviation from this method by entering into the realm of the teaching hospital departments, so far considered the monopoly of the clinicians. I assigned a student of anatomy to assist the Resident Pathologist at autopsy work. The object of this arrangement was to enable an anatomist to handle internal organs and study their relations in as fresh a state as possible. His reactions are reproduced below:

"When an autopsy room forms a part of a teaching institution, it gives us a mine of information.

"Apart from the overwhelming advantages of number and variety, as against the crippling scarcity of cadavers for anatomical dissection, the bodies for autopsy lend themselves to the study of anatomy at all ages and in both sexes and in as life-like a condition as possible. The tissues appear fresh to the touch, and true in colour to the sight. The organs are soft, pliable and easily displaceable; the serous membranes are shining and show the normal anatomical relations; the adipose tissue and the muscles appear most natural. The universality of vascular supply is only evident here.

"These features are lost to a great measure in a formalin-hardened, embalmed cadaver, many parts of which are invariably decomposed by the time the student dissects it. An autopsy body is like a text-book, ever available and ready to be read at any time. A formalin-hardened cadaver, on the other hand, is like a rare reference book to be made the most of as and when available."

RADIOLOGY

Utilisation of radiology department was the assignment of another lecturer. He visited the department regularly and learnt a considerable amount of radiological anatomy and collected a valuable series of X-ray plates which are such a great help in studying the structure of organs, distribution of vascular supply and the anastomosis at various places (slides-hepatograms,

DURATION OF TRAINING PROGRAMME AND METHODS OF ASSESSMENT

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THERE is a considerable difference of opinion regarding the duration of the training programme for the postgraduate courses in Medicine. I may say at the outset that, whatever the duration of the programme, one factor of great importance is "how intensive and well-supervised the training programme is." I am inclined to think that in many of the colleges, the training programmes for postgraduates are neither intensive nor of adequate duration. In some institutions short courses of intensive training are being given but for the rest of the period of training the student is left to his own initiative. Undoubtedly, many of them work hard but they are often, for a major portion of the training period, without close supervision and guidance and without any responsibility as regards patients' care, etc.

Generally speaking, both for the clinical as well as the non-clinical subjects the prescribed period of training before a candidate can appear for MD/MS examination is as follows:

(a) One year of compulsory rotating house job which cannot be really regarded as postgraduate training as it is in fact a portion of the undergraduate course.
(b) One year of house job after full registration,
(c) Two years of active training as a postgraduate student.

In this period of two years, the student has to write a thesis or a dissertation which takes a considerable time for its completion in certain universities though in certain others the dissertation is of a type which may not be very time-consuming. This means that actually the student devotes himself as a whole-time trainee for a period of about one year or a year and a half only, because for the first six months he is engaged in working for his thesis and getting it properly compiled. It is thus obvious that we cannot regard this training period as really adequate.

The period of training depends upon what our ultimate objective is. Are we producing full-fledged specialists and teachers and scientists at the end of their training period, that is to say, when they pass the MD/MS examination, or are we producing at this MD/MS level those who have acquired an adequate academic and scientific background and a certain degree of practical experience to enable them to progress further after passing the examination, by acquiring practical training in a clinical discipline, or a speciality at later stages. It is obvious that under the present set-up in this country we are not aiming at producing the first category. The USA Speciality Boards are aiming at that, for they prescribe an adequate period of training in general disciplines and then in the speciality concerned before a candidate is allowed to take his examination in any speciality. The total period is seldom less than four years and in many speciali

week spent by the pharmacologists in the wards can lead to more rational thinking, learning and teaching both on the part of pharmacologists and clinicians. Such an arrangement operating for the last two years at our institution has proved very instructive.

A natural outcome of such an association has been the establishment of the Clinical Pharmacology Unit at the Seth G. S. Medical College.

In conclusion, I would say that close collaboration among the preclinical, the paraclinical and clinical departments is of utmost importance for the furtherance of the knowledge of our teachers and for proper guidance to the postgraduate students. The teaching hospital, thus, plays a very vital role in postgraduate education in all disciplines.

paid more than they could afford for the undergraduate education of their sons and daughters.

This question is also bound up with the major question of whether we are going to allow MD and MS degrees only in the main disciplines, such as Medicine and Surgery. Most teachers in general disciplines think that a candidate must do MD or MS in a general discipline first before he goes in for any speciality. The specialists, on the other hand, are of the opinion that such a step will discourage a student from coming into specialities because the time taken for such specialisation will be very long and that indirectly it will preclude the postgraduates, especially the brilliant students, from taking up such specialities. We have to admit that there is a good deal of weight in this argument. However, if the period of training is increased by one year as proposed above, we may be able to solve amicably the question of MD and MS degrees in such specialities, for in that case we may prescribe, according to the needs of any particular speciality, a certain period of training in the general disciplines during the course of four years for MD/MS in that speciality.

I have not said anything about diplomas in various specialities. I think most people agree that, except for a few specialities like Psychiatry and Radiology, one year's course is enough to pass the examinations in these diplomas.

Methods of Assessment. Most Universities require that MD and MS candidates must write a thesis which has to be accepted by the examiners before a candidate becomes eligible to take an MD or MS examination. I think this practice should be kept up as, at any rate, it introduces the young student at the postgraduate level to the methodology of research. He cannot get this opportunity until many years later in his career. However, if the intention is what I have stated above, then it is essential that the subjects chosen for the thesis should be such for which a proper methodology of research is to be pursued and the student is initiated into the laboratory work as well as intensive reading in the library for purposes of a broad-based study of the subject and getting references, etc. If the theses that are produced are of a lower standard and are mainly disserations involving no real research, the object is defeated, as the young student at this stage of his career is then likely to conclude that what he is doing is real research and thus may form a wrong notion about what research should be. He must be guided actively and supervised closely by his guides who should not have too many students under them writing theses on varied subjects, because no teacher or research worker can claim that he can give guidance to a large number of students on a vast variety of subjects effectively.

There should be day-to-day assessment of the students especially if they have been assigned a responsible task as regards patients' care. In addition, their aptitude for research—especially for laboratory work—their progress, their efforts to learn from all possible sources such as their teachers, associated specialities and the library, especially as regards current advances, their attitude towards patients, etc. must all be evaluated. As our aim is to produce teachers, the student must be given some practice in undergraduate teaching and his capability as a teacher should be assessed. Such teaching in early stages should be done under the guidance of a senior teacher. This day-to-day assessment may not form a direct part of the

ties it is more than four years, after the first year of internship which corresponds to our rotating house job. In England the periods prescribed for MRCP and FRCS examinations are shorter because their aim corresponds to what I have put down above as the second type of objective of such training, though I must say that in the long run most of those who pass these examinations come up to the same standard of specialisation as those getting training under the American system, as after passing the MRCP or FRCS examinations they undergo further apprenticeship in the practical aspects of Medicine or Surgery or in any of the specialities of these disciplines. In the U.K. suitable facilities for such training are being provided and adequate training and experience after obtaining the postgraduate qualification is an essential prerequisite for acquiring the status of a specialist. Both systems are producing good specialists, good teachers and first-rate scientists and any of the two systems can be adopted. However, even if we keep our objective the same as what it is at present, we have to give serious consideration to the following points:

(i) Is the duration of training adequate?
(ii) Is the training that we are giving intensive enough?

The second question does not come under the purview of the subject under discussion. As regards the first question, I think most of you will agree with me that at present the training period is certainly not adequate to fulfil the requirements if we intend to produce full-fledged specialists. Even if we want to produce only those who may after obtaining the MD/MS degree try to become specialists after getting further training as Registrars, etc., this period seems to be meagre even for that purpose especially as almost one year out of it is spent in writing a thesis. Many educationists often state that after all if the Royal Colleges in the U.K.—both in Medicine and Surgery—are allowing candidates to be eligible for taking these examinations without prescribing long periods of training after graduation and full registration, as the American Boards do, why should we increase the training to a longer period. They forget that in the United Kingdom the prerequisites for the MRCP and FRCS examinations do not envisage the writing of a thesis in partial fulfilment of the requirements for those examinations and thus they need a shorter time for becoming eligible to those examinations. Moreover, they have provided adequate facilities for training after the postgraduates have passed these examinations. Such opportunities are not available in all places in this country. I think most of the teachers will agree that the period of training for the MD and MS degrees should be increased by one year, that is, it should be four years after full registration inclusive of one year of house job in addition to the compulsory rotating housemanship. However, while academically this proposition looks very sound, there are difficulties in the way of its fulfilment. These difficulties are:

(1) All Universities should be willing to adopt the system.
(2) There should be more money for scholarships, for at the P. G. level the Central and State Governments must pay all the expenses and we should not throw this additional financial burden on the parents of the candidates. They have in nearly all cases

Paper III : General Ophthalmology including Ophthalmic Surgery
Paper IV : Other clinical disciplines as applied to Ophthalmology

4. E.N.T.
Paper I : Basic Sciences as applied to Otorhinolaryngology
Paper II : Otorhinolaryngology
Paper III : Otorhinolaryngology
Paper IV : General Surgery and other clinical disciplines related to Otorhinolaryngology

5. Anatomy
Paper I : Allied subjects related to Anatomy
Paper II : Anatomy
Paper III : Anatomy
Paper IV : Applied aspects of Anatomy

APPENDIX II

Regulations for the Degree of Doctor of Philosophy (Ph.D.) of the A.I.I.M.S.

1. This Degree shall be given in the subjects of (1) Anatomy (2) Physiology (3) Biochemistry (4) Pharmacology (5) Pathology (6) Microbiology which will include Parasitology as well (7) Entomology (8) Experimental Medicine and (9) Biophysics.

2. Every candidate for the Degree of Ph.D. in a particular subject must have obtained the degree of M.Sc., M.D., or M.S. in any one of the above subjects or in any clinical subject including Preventive & Social Medicine of this institute or of any other University recognised by this institute and must spend not less than two full years as a wholetime research worker in the respective department of this Institute after registering for the degree.

If necessary the candidate may be asked during enrolment period by the supervisors to go for short periods to other centres or field areas where material on special investigations for the completion of his thesis may be available.

Some extra research work at some other centre in connection with the project, at the candidate's discretion, in addition to two years stay of the candidate in the Institute will be permissible if the supervisor approves of it.

3. The candidates can *enrol* themselves for this degree *before 15th July or 15th January but the period of 2 years work will be reckoned only with the date of registration which shall be either 15th July or 15th January.*

4. The work done for the Dergee of Ph.D. shall be under a recognised teacher of the Institute who will be known as the Chief Supervisor. An Additional Supervisor shall be nominated for each candidate for providing help and guidance. The Additional Supervisor shall act as the Chief Supervisor in the absence of the Chief Supervisor. Before the candidate is allowed to take his final examination, he shall present a certificate signed by the two supervisors certifying that the work was done by the candidate himself. In the case of research project in which contributions have been made by others, the candidate must state clearly in the thesis the contribution made by him and those made by others.

6. Obstetrics and Gynaecology
   - Paper I : Basic Sciences as applied/related to Obstetrics and Gynaecology
   - Paper II : Obstetrics
   - Paper III : Gynaecology
   - Paper IV : Other clinical disciplines as related/applied to Obstetrics and Gynaecology
7. Physiology
   - Paper I : Allied subjects related to Physiology
   - Paper II : Physiology
   - Paper III : Physiology
   - Paper IV : Applied aspects of Physiology
8. Pathology
   - Paper I : Allied subjects related to Pathology
   - Paper II : General and Special Pathology
   - Paper III : General and Special Pathology
   - Paper IV : Applied aspects of Pathology
9. Microbiology
   - Paper I : Allied subjects related to Microbiology
   - Paper II : General Bacteriology
   - Paper III : Special Microbiology
   - Paper IV : Applied aspcets of Microbiology
10. Biochemistry
    - Paper I : Allied subjects related to Biochemistry
    - Paper II : General Biochemistry
    - Paper III : Biochemistry
    - Paper IV : Applied aspects of Biochemistry

M.S.

1. Surgery
   - Paper I : Basic medical sciences as related/applied to Surgery
   - Paper II : General Surgery including Surgery of Trauma, Fasciomaxillary and Neuro-Surgery
   - Paper III : Surgery *including* Cardio-thoracic, *Urogenital, Principles of Plastic Surgery*
   - Paper IV : Other clinical disciplines related/applied to Surgery
2. Orthopaedic Surgery
   - Paper I : Basic Sciences as applied to Orthopaedics
   - Paper II : Orthopaedics
   - Paper III : Orthopaedics
   - Paper IV : General Surgery and other clinical disciplines related to Orthopaedics
3. Ophthalmology
   - Paper I : Basic Sciences (e.g. Anatomy, Physiology and Optics) as applied to Ophthalmology
   - Paper II : General Ophthalmology including Ophthalmic Pathology

(a) French (b) German (c) Italian (d) Spanish (e) Russian. There should be no examination in the above languages but a certificate from the supervisor about the candidate's ability to follow the scientific literature in the foreign language would be sufficient. However, till proper facilities are available in the Institute campus, it will not be obligatory for the candidate to learn such languages. However, due credit would be given to the candidate who has learnt one of the above-mentioned foreign languages.

(5) The candidate shall be declared to have passed after a unanimous approval by the board of examiners. The candidate will be required to re-appear for another oral examination after 2 months in case the examiners are not satisfied with his performance.

8. The thesis may be submitted any time after the minimum prescribed course of study, but three months before the end of the session.

9. In no case the thesis may be re-submitted more than once and then within a period of 5 years after the date of registration.

10. The fee for Ph. D. examination shall be Rs. 300.00.

11. The Lab. fee shall be the same as for M.D./M.S., i. e. Rs. 40.00 (payable in two equal instalments).

12. *Research Fellowship.*

All candidates admitted for the Ph. D. Degree shall be considered for the award of a research fellowship of *Rs. 250/- p. m. irrespective of their being medical or non-medical post-graduates.*

NB : (1) Experimental Medicine will include experimental work in all clinical sciences.

(2) M.Sc. in Physics, M.Sc. in Chemistry (specially with Physical Chemistry) and M.E. in Electronics will also be allowed to do Ph.D. in Biophysics, provided their knowledge of Physics was adequate enough to make them suitable candidates.

All the Ph. D. candidates in Biophysics will have to spend three years out of which, for medical candidates, one year will be spent in training in basic sciences like Physics, etc. and for non-medical candidates that period will be spent in learning Biological Sciences.

5. The Degree of Ph.D. shall be conferred after the acceptance of a thesis written on the subject of special study and after the candidate has passed in oral examination.

6. *Thesis*

(a) Each candidate shall register the subject of his thesis within six months of his enrolment with the Dean which will be approved by a board appointed for the purpose.

(b) Each candidate for the Degree of Ph.D. shall submit 3 copies of his thesis after the completion of his course of study.

(c) This thesis in any field must give evidence of the candidate's originality and ability to conduct independent investigations. It must make a real contribution to Medical & Biological Sciences. Parts of the thesis may be published with the approval of the Dean in reputed and well established journals during the course of the work.

(d) A board of two external examiners shall be appointed to evaluate the thesis.

(e) The external examiners should give detailed comments on the thesis submitted by the candidate.

(f) These comments should be made available to examiners (vide infra) before they conduct the viva-voce examination.

(g) The foreign examiners of the thesis if any may be requested to send questions to be put to the candidate at the viva-voce examination.

(h) The candidate will be entitled to appear before a board of examiners only if his thesis has been approved unanimously by both the external examiners.

(i) If the thesis is not unanimously approved, the candidate will be given another chance for re-submission of his thesis only on the specific recommendation of the external examiners and not as a routine, after his pursuing a further course of study at the Institute for not less than six months.

7. *Oral Examination*

(1) The board of examiners for the oral examination shall consist of 2 external examiners (ordinarily those who examined the thesis) and the two supervisors for the thesis.

(2) It would be desirable to appoint two additional examiners from the Institute or outside having expert knowledge of the subject or in the related field of study of the candidate so that at the viva-voce examination the candidate's general proficiency in the subjects allied to the field of his/her study may be tested. This however should not be a compulsory provision.

(3) After the thesis has been approved an oral examination shall be held. In this oral examination further evidence of the candidate's proficiency in the major fields of his study and his ability to defend his thesis must be demonstrated.

(4) If facilities are provided at the Institute campus to teach some foreign languages, the candidate should be conversant with at least one of the following languages ;

CONTINUING MEDICAL EDUCATION

COL. SANGHAM LAL, F.R.C.S., F.A.M.S.

WITH the very rapid advancement of medical research and new discoveries in the field of causation, pathology and treatment of disease, it is not possible for a medical man to remain satisfied with the knowledge he possessed at the time of starting his professional work. It is, therefore, necessary that a doctor must be a life-long student of disease and man. It is important to realise that it is the doctor himself, and not the patient, who must be the judge of how far his knowledge is adequate for a proper examination and treatment of his patient.

For practical purposes, therefore, continuing medical education may be considered to start from the time a doctor settles down to work either as a general practitioner or as a specialist.

In most countries no organised programme is followed and general medical practitioners and the specialists are left to arrange their continning education themselves. This is done by (1) reading of general and specialist journals, (2) participating in meetings of national and local Specialists' Association and, if possible, International Specialist meetings, (3) refresher courses, lectures, films and seminars, etc., arranged by medical associations or medical colleges and (4) study trips to other centres in and outside the country. It must be acknowledged that this self-education is not very satisfactory and, therefore, it is important that the programme of education should be organised in a systematic manner.

In the United Kingdom, the Ministry of Health has delegated the responsibility for providing continuing medical education for the specialists and general practitioners on the National Health Service to the universities having medical faculties.

In London a highly organised machinery has been set up in the form of British Post-graduate Medical Federation under the control of the London University. The Federation is responsible for the administration of 15 specialist Postgraduate Institutions, each associated with a hospital of the special branch concerned (the hospitals are administered by Hospital Boards under the Ministry of Health). With 15 specialist institutes and the Postgraduate Medical School at Hammer-Smith Hospital, London is in a better position than any centre in the country or perhaps any country in the world to provide continuing education for specialists and general practitioners.

The Federation arranges various conferences and symposia for the specialists. The expenses for such meetings are met by University Grants Commission. For general practitioners two weeks' courses varying from continuous course for half a day a week or short week-end courses lasting 1-1/2 days are arranged by the Federation, thus enabling them to attend to any course convenient to them It is important to note that for every practitioner who takes up such a course the Ministry pays the University a certain sum towards tuition fees and general expenses. They also pay the T. A. and subsistance expenses of each practitioner and, if necessary, they contribute towards providing a substitute to carry on the work of the practitioner attending a full-time course. In this way, considerable encouragement

Recently, the Indian Medical Association has organised a college of general practitioners. In September last, a very successful session of an orientation course was conducted in New Delhi. It is expected that such courses will be held at the State levels by State Medical Associations.

In India the pharmaceutical industry in the process of bringing their products to the notice of the doctors are playing an important role in continuing education. Many firms issue regular monthly or quarterly pamphlets giving excellent description of various diseases, along with extracts from newly publised books. Many a practitioner depends only on this source for the latest information on many subjects.

It is highly desirable that more co-ordinated efforts in pursuing this objective should be made by the government and the Medical Association. The appointment of a Director of Medical Education and Research in some States appears to be a good innovation. It is felt that the Director of Medical Education should undertake the responsibility of more organised training programme for not only government employees but for the general practitioners as well. He should also obtain active co-operation from the Indian Medical Association. In this way he can combine the pattern of London Postgraduate Federation and California programmes.

It must be emphasised that the government should be prepared to pay the travelling and daily allowances to the doctors who attend these courses even if they are not in government service.

I may here make a plea for the more frequent use of audio-visual methods such as projection slides, films, etc. In Western countries, even television is being used. In India there is a great scope for using educational films for teaching purposes and there is a great need for a central medical films library. I am glad to say that the Indian Academy of Medical Sciences is actively considering a scheme for setting up such a library for high-class medical films which would be lent for use for educational purposes. It is also proposed to encourage the making of medical films in the country. At present only a few medical scientists have prepared films of their work through personal efforts.

officers are permitted to go to teaching centres in India and foreign countries for further studies and they are also encouraged to take up specialist qualifications during study leave. Out of 3,000 doctors in the services, about 10% are usually engaged in advanced training programmes.

State Railways employ about 2,000 doctors. I understand that they encourage a selected few to undertake postgraduate training. They also send their doctors to attend refresher courses held in the teaching institutions.

I do not know if the Contributory Health Scheme and the E.S.I. arrange any organised programme of continuing education.

In the States the programmes differ from State to State. It is hoped that most states do organise refresher courses in the State Medical Colleges for the benefit of government employees and local practitioners in the States.

Sometime back the Madras Government arranged to hold demonstration and teaching sessions in the district hospitals besides having refresher courses lasting 3.4 weeks. Each medical college had the responsibily of arranging such programmes in 3 or 4 districts. The programme which lasted about 2 weeks was attended by professors from a particular medical college who stayed there for one or two days to give lectures and demonstrations in their subjects. Such courses were attended both by government doctors and private practioners in the locality. The Director of medical services also issued a quarterly medical bulletin containing articles written by teachers in simple language giving information about recent advances in medical sciences. Such bulletins were issued to all medical officers in service and were also available for the general practitioners through the Medical Association at a nominal price of four annas.

ROLE OF MEDICAL COLLEGES IN THE CONTINUING MEDICAL EDUCATION

It is not possible to think of any organised programme without the active co-operation and participation of the teachers of a medical college. It is highly desirable that teachers of all medical colleges should actively participate in such programmes, which, I am afraid, is not the practice at present.

ROLE OF INDIAN MEDICAL ASSOCIATION

The Indian Medical Association has done very good work in this direction by voluntarily taking up the responsibility upon itself. For example, the Delhi Medical Association is arranging regular weekly lectures by teachers of the local medical colleges and visitors from abroad on a variety of subjects. At the annual meeting a very successful scientific session is being conducted. In the districts, monthly scientific meetings are held under the auspices of the I.M.A., usually in the government hospital with the hospital staff actively co-operating in it.

The Medical Association has a library where books and journals are available for the practitioners. A journal of the Indian Medical Association is also being published fortnightly.

By making such a provision we shall also be preventing a large number of students from going abroad for obtaining postgraduate diplomas and degrees. At present, students go abroad either because they cannot get admission to such degrees in our colleges or perhaps some feel that diplomas and degrees that are being awarded in the U.K. and America, because these have already established a high reputation, are more covetable. Therefore, to provide necessary facilities to our students and raise the standards of postgraduate medical education in the country, we must introduce such examinations. In my opinion, such examinations should be introduced for all major clinical, preclinical and paraclinical subjects. The details of the rules and regulations for such examinations in individual subjects will, of course, differ but a general pattern is being suggested here which may later be modified according to individual speciality.

ELIGIBILITY

Candidates, who have obtained M.B.B.S. degree of any Indian University or any other equivalent degree recognised by the Medical Council of India or any other equivalent qualification and have completed rotating housemanship or internship training and fulfil the following criteria, are eligible:

I (i) has worked as a House Officer in a teaching or a recognised hospital for a period of 12 months

Or

(ii) has completed one year junior teaching appointment in the case of basic medical subjects in which the candidate wants to take the examination

Or

(iii) has been in the active practice of medicine continuously in the speciality for a period of 4 years in lieu of one year's housemanship

II and has received full registration from the Medical Council of India for at least 4 years, provided :

III these candidates who satisfy the above minimum criteria show evidence of satisfactory training programme in the speciality as detailed below.

After completion of housemanship of one year or other equivalent criteria stated above, the candidate must work for 3 years in the speciality or in the subject in which he intends to take the postgraduation under a recognised guide or specialist or a teacher, as approved by an appropriate authority. Thus the minimum period of training would be 4 years after compulsory housemanship but candidates who have already obtained a postgraduate degree in the speciality, such as M.D., M.S. or any equivalent diplomas, and have completed 4 years' period after their compulsory housemanship, will automatically become eligible for appearing in these examinations.

NATIONAL EXAMINATIONS

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SINCE Independence our country has made rapid strides in various spheres and amongst these, to my mind, in the field of medical education there has been a tremendous progress. The number of medical colleges has increased more than fourfold and the students admitted every year undergraduate training have increased from two thousand to over ten thousand. Moreover, a fairly large number of candidates are now undertaking postgraduate training for various degree and diplomas which are awarded by the different universities in our country.

In spite of such a large increase in numbers, a need for the establishment of national examinations on an all-India basis is strongly felt. Such examinations will introduce uniformity in the field of postgraduate medical education which at present differs from university to university. It is felt that introduction of such an examination will immensely help in raising the standards of postgraduate medical education in the country and also the calibre of specialists in various fields of medicine.

We are all aware of the great role played by the Royal Colleges of Physicians and Surgeons in Great Britain in maintaining proper and uniform standards of postgraduate medical education in that country and also the calibre of the specialists. In fact, in Great Britain these diplomas are more or less considered a *must* for persons who wish to specialise in the field of medicine and surgery and practice as specialists.

In marked contrast to such examinations, in the United States the postgraduate training which is called graduate training, leading to specialists' competence in the field of clinical medicine, is primarily oriented towards certification by a Speciality Board. There they lay a lot of stress on practical training of the students.

In the field of medical education the system followed in Great Britain has been adopted in our country and emphasis has been laid on the acquisition of academic degree rather than on the training of the candidates before they are permitted to appear for the examination. It is a pity that we have not included in our system of medical education the good points that are present in the American system of training.

The objects of introducing such national examinations are as follows:

1. To set up a uniform standard of postgraduate medical education throughout the country.
2. To achieve high professional standards of postgraduate medical education as well as of various specialities in the country.
3. To produce specialists in various fields of medicine and both basic and clinical sciences.

In these examinations it is desirable to debar a candidate from taking subsequent examinations if he does not reach a proper standard in one examination, whether written or clinical or practical. In fact, if the candidate has done remarkably well in the previous parts of the examinations, the examiners may even exempt him from viva voce examination. This should be done only in case of extraordinary brilliant students but ordinarily all the students should be required to appear in the final viva voce examination where the examiners will try to screen the depth of the knowledge of the candidate.

RESEARCH WORK: ITS SIGNIFICANCE AND TRAINING

If a candidate has shown evidence of some good original research work and has published papers, the same may be taken into account at the time of examination in the final assessment of the candidate Candidates who have done good research work may even be exempted from Part I examination.

CENTRE OF EXAMINATION

These examinations should be held at 4 or 5 centres throughout India, in rotation every year, and no particular place should get preference over the other, and the candidates belonging to a particular place may not ordinarily take up the examination at the centre of his studies. This will avoid the question of favouritism and undue advantage to a person who belongs to a particular institution where the examination is held.

EXAMINERS

Senior postgraduate teachers will be appointed examiners and there will be a minimum of 4 examiners though there may be more depending on the number of candidates, but ordinarily, no candidate will be examined by a person under whom he has received training.

These are some of the broad principles on which such examinations can be introduced. Further details will have to be worked out regarding each subject as and when a policy is approved by the specialists working in that field. Thus, if we succeed in introducing such national examinations for which one feels a great necessity at the present stage of development of medical education in our country, we would have achieved a lot.

Such examinations should, under no circumstances, come into conflict with any examination held by a university or by any other organisation in the country. These examinations will be open to inspection by the Medical Council of India so that they may be satisfied about the standards of the examinations. It will be appropriate that a statutory body recognised by an act of Parliament be authorised to conduct these examinations, or these examinations may be handed over to the Indian Academy of Medical Sciences which may be authorised to give such examinations by a law enacted by the Government of India. This is a matter of policy and it may be decided by appropriate authorities but, in my personal opinion, I strongly feel that the Indian Academy of Medical Sciences, as it is composed today, consists of eminent medical scientists and educationalists of the country and is an appropriate body to conduct these examinations and these should not come into conflict with any other organisation.

METHODS OF TRAINING

The trainiog of candidates will he carried oot io the recognised institutions. Sucb institutions should be properly equipped for the teaching of basic medical sciences for those who wish to take National Examinations in clinical subjects, in Anatomy, Pbysiology, Biochemistry, Patbology, Pharmacology, etc. The caodidates who are taking the examinations in basic medical sciences should also he taught some of the allied clinical subjects and allied basic sciences for a period of at least 6 montbs. In the remaining period the candidate would devote himself to the study of the speciality itself, together with various aspects of the speciality, thus enabling him to get a sound hackgroond of the subject both in its theoretical and practical aspects. The candidate workiog for clinical suhjects and preventive and social medicine will also receive practical training in rural medical and bealtb problems, preferably in a rural setting.

EXAMINATIONS

These examinations in my opinion should be split up in two parts : Part I and Part II. The first part should have a bearing on basic medical sciences in case of clinical subjects but in case of basic medical scieoces to a certain extent on allied clinical subjects togetber with other allied basic sciences. Details of this could be worked out later keeping in view the various specialities.

The candidates for Part I examination can appear at any time after the completion of their housemanship period of one year or in case of basic medical sciences after one year of junior. teaching appointment in a basic medical subject, but they can only appear in their final Part II examination after completion of. the .period that has been mentioned above.

Thus, the introduction of Part I examination will not only ensure training and competence in basic medical subjects but also help in screening the student at this level and the persons who are not up to the standard will automatically be eliminated at this stage.

This in my opioion should only be a written examination and it is not necessary to have any practical examination for this. The question of bolding a viva-voce examination may also be. considered. The candidate who fails to clear Part I examination can reappear in Part I examination and can continue in the training of the speciality of his choice.

It should also be noted that candidates who already possess degrees, such as M.D. or M.S. or M Sc./Ph.D. or any other equivalent diploma or degree, will be exempted from Part I examination.

Part II examination will consist of written, practical, clinical and viva voce tests : the written examination wilt have 3 papers and the practical examination will be held in the laboratories and the clinical examination in the recognised hospitals where candidates will be required to examine patients.

Finally, the viva voce examination will he held after the candidate has been examined in the written, practical and/or clinical examinations.

should follow one another. A theme should be enunciated and constantly sustained throughout its numerous variations.

Clinico-physiological and clinico-pathological conferences should be developed as means of integrating clinical and preclinical teaching and of inculcating a critical outlook.

The best qualities of a teacher are innate and, therefore, these are incapable of precise definition. Some have natural handicaps which make them bad teachers, and which they can never overcome. But the rest, provided they are enthusiastic, could undoubtedly profit from instruction. A conference can make them aware of their faults and limitations. Senior teachers can awaken a sense of responsibility for training and selection of their successors.

TRAINING OF TEACHERS, SPECIALISTS AND INVESTIGATORS

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IT is a very heartening feature that, in recent times, medical teachers themselves have begun seriously to examine their practices and to seek ways of improving them. The need in this direction is for a broad, philosophical approach as much as a technological and instructional one. The ideals of conversation and interpretation of knowledge and search for truth cannot be overemphasised.

The difference between the young and the old teacher is not so much of age as of mental outlook. Young teachers have the advantage of being close to their students, and are in a position to establish an intimate relationship of give and take with their class. They also lack the philosophic doubts of their elders and are able to leave students with a number of sharply defined images which they could remember. The teacher's job is to preserve the inherited tradition of knowledge and to stimulate the intelligent individuals to add to it.

The training of young specialists requires that each step must at first be learnt empirically. The apprentice must try his hand under the master's eye and receive approval or correction of his work. He should begin with simple tasks and move on to more difficult ones only when he has proved his capacity. The practice of teaching or failing to teach by giving unlimited responsibility to the untrained has nothing to commend itself.

A research training and outlook are essential to the equipment of a teacher. It is, however, wise to scrutinise the motives for research. A wise guide would always look carefully at some one with an idea or a piece of work which he had already done. Others, less original, might feel an urge to take part in some specific project and could prove useful members of a team. Research is a laborious discipline full of frustrations and uncertain rewards and it means sacrifice of the immediate satisfaction of clinical work, and of many pleasant social pursuits. The initiation of the young investigator should, therefore, be a tardy process. He should at first be given facilities but little help, for the real test of a man comes when he has to surmount difficulties. If he overcomes this with energy and initiative, then he should be helped to the maximum extent.

The ideal raw materials for the training of future medical teachers, specialists, and investigators are, in the majority of cases, the resident house officers in teaching hospitals. The resident is the totipotential cell of medicine: the doctor, able to treat patients safely and with sympathy; the humanist, scientifically trained; the artist, equipped for research. Such a man must acquire a technique of collecting facts and a method of scientific thought, and yet not lose the common touch. He has to learn many facts, some of them empirically, before he can understand them. Many of the doctors learn by precept and the teachers whom they appreciate do not possess dogmatic minds. What is important is that factual learning and understanding

First Unit	Second Unit	Third Unit
Director-Professor	Professor	Associate Professor
Assistant Professor	Assistant Professor	Assistant Professor
Senior Lecturer	Senior Lecturer	Senior Lecturer
Lecturer	Lecturer	Lecturer
Registrar	Registrar	Registrar

Each unit would be in charge of 50 beds and would be responsible for teaching the postgraduates, both in the in-patients and in the out-patients of the hospital. Such a department, as mentioned above, could easily train 15 postgraduates at the same time, allocating five postgraduates to each unit which will be responsible for guiding the research and theses of these five students. The postgraduates could rotate from one unit to another after an interval of six months in order to be able to have a broad-based training under different sets of teachers.

ANCILLARY STAFF

It is also necessary to provide the following ancillary staff for this department:

1. Stenographers	3
2. Technicians	4
3. Clerks	2
4. Class IV servants	4

The above staff would provide the necessary help to carry out all the secretarial work which is usually being done by highly paid specialists in most of the medical colleges and institutions in this country. Once the above staff is provided, it would leave the surgeons sufficient time and leisure to pursue research on their own and to guide the research problems of the postgraduates placed under their care.

EQUIPMENT

Apart from the diagnostic tools needed in the out-patient and in-patient departments, sufficient surgical equipment should be provided in the operation theatres. For the proper training of the postgraduates, the special equipment and other special needs of departments are as follows:

(a) Microscopes, epidiascope, 35 mm. projector, microtome, cabinets for keeping slides, photographic material, specially a 35 mm. camera with all the accessories.

(b) Departmental Library: This should be in close proximity to the location of the department of surgery, so that the books and journals are available to the members of the staff and the postgraduate students. This should have most of the recent books on surgery as well as the important journals on surgery.

(c) Department of Experimental Surgery: This department should be built in close proximity to the hospital to save time of the teachers and the postgraduates who will

THE ORGANISATION OF POSTGRADUATE DEPARTMENTS

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IN order to be able to train postgraduates in medicine, surgery and their various specialities, it is absolutely essential to have a large-sized teaching hospital. The number of beds of a hospital has to be carefully related to the number of postgraduates that have to be trained in the various departments. A specialist clinical unit of 50 beds could train not more than 5 postgraduates at one time. In other words, in order to give adequate clinical experience to the postgraduates in general medicine and its specialities and sufficient operative experience to the students in surgery and its various specialities, we should have a 1,000-bed hospital if we wish to train 100 postgraduates. It is desirable that at least 150 beds should be reserved for general medicine and a like number for general surgery so as to provide three units in each of these two major departments. The specialities of medicine and surgery should have 50 beds each. The departments of obstetrics and gynaecology will, however, have to be given a larger share and at least 75 beds should be provided for this purpose.

The following recommendations are, therefore, being made as regards the teaching and ancillary staff of the various departments:

STAFF OF THE DEPARTMENT OF GENERAL SURGERY

In order that a well-planned training programme for the teaching of the postgraduate can be conducted in the department of surgery, it is absolutely essential that the staff should consist of:

1.	Director-Professor	1
2.	Professor	1
3.	Associate Professor	1
4.	Assistant Professors	3
5.	Senior Lecturers	3
6.	Lecturers	3
7.	Registrars	3

The Director-Professor would be the chairman of the department and will guide the various units of surgery in addition to supervising the research work. He will also have to carry the administrative load of the department. As proposed above, there should be 150 beds for general surgery. These could easily be supervised by three general surgical units. The above staff could be split into three units:

The staff of each of these specialist departments should consist of the following:

1.	Professor	1
2.	Assistant Professor	1
3.	Senior Lecturer	1
4.	Lecturer	1
5.	Registrars	2
6.	Stenographer	1
7.	Technicians	2
8.	Clerk	1
9.	Class IV staff	2

DEPARTMENT OF GENERAL MEDICINE

The Department of General Medicine should be organised on the same lines as the Department of General Surgery since it is essential that all the postgraduates who are going to get training in the various specialities of medicine should have training for a sufficiently long period in general medicine before they start training in one of the specialities. The staff for the Department of General Medicine should be the same as for the Department of General Surgery.

SPECIALITIES OF MEDICINE

The specialist services of the Department of Medicine should consist of the following departments:

1. Paediatrics
2. Neurology
3. Psychiatry
4. Dermatology
5. Cardiology
6. Endocrinology and Metabolic Diseases

The staff of each of these specialist departments should be the same as recommended for the specialities of surgery.

OBSTETRICS AND GYNAECOLOGY

The staff of this department should consist of the following:

1.	Director-Professor	1
2.	Professor	1
3.	Associate Professor	1
4.	Assistant Professors	3
5.	Senior Lecturers	3
6.	Lecturers	3

also be busy with the patient care in the hospital. The proximity of the laboratory and rooms of experimental surgery to the teaching hospital would enable the teachers and the postgraduates to spend regular hours, at least two to three times a week, in experimental surgery. It is essential that the department of experimental surgery should be well equipped and well planned. It should provide sufficient rooms for keeping the animals and one or two rooms which should be air-conditioned for intensive therapy and post-operative care of animals on whom critical operations will be performed from time to time. Also, it will be essential to provide in this department at least one, and if possible two, specially designed operation theatres with all the necessary facilities for sterilisation, storage and provision of sterile supply for purposes of carrying out the routine operative procedure on animals. Further, a comparatively large-sized room, 60 ft.$\times$25 ft., should be provided for teaching operative techniques of surgery to the postgraduates on experimental animals. This would be a valuable experience as the trainees would be operating on living animals and would be in a way imitating the conditions they are likely to meet with in their surgical practice. Further, a member of the team, consisting of postgraduates, could also be made responsible for giving anaesthesia, another for carrying out pre-operative and post-operative care and the course of the operation. This exercise could be carried out over a week, and could easily be supervised by the senior members of the surgical staff.

ACCOMMODATION

Apart from the accommodation needed for hospital operation theatres and experimental surgery facilities, the following accommodation would be needed for the Department of Surgery:

1. Sufficient departmental rooms for the staff mentioned above.
2. Room for departmental library.
3. At least two rooms for holding seminars where the students can be taken in small groups round a patient who can be wheeled in from the neighbouring ward for purposes of teaching.
4. One large lecture theatre which could be shared by other departments also.
5. An auditorium where regular, weekly clinico-pathological conferences, seminars and clinical meetings can be held.

SPECIALITIES OF SURGERY

The specialist services of the Department of Surgery should consist of the following departments:

1. Neuro-Surgery
2. Orthopaedic Surgery
3. Cardiovascular and Thoracic Surgery
4. Genito-Urinary Surgery
5. Paediatric Surgery
6. Plastic Surgery

Radiotherapy

1.	Professor	1
2.	Assistant Professor	1
3.	Senior Lecturer	1
4.	Lecturer	1
5.	Tutors	2
6.	Stenographers	2
7.	Technicians	8
8.	Clerks	2
9.	Class IV staff	10

ANAESTHESIOLOGY

This department has to work with several specialist units including general surgeons. The staff should consist of the following:

1.	Professor	1
2.	Associate Professor	1
3.	Assistant Professors	3
4.	Senior Lecturers	3
5.	Lecturers	3
6.	Tutors	10
7.	Stenographer	1
8.	Technicians	2
9.	Clerk	1
10.	Class IV staff	10

PATHOLOGY

The staff should consist of the following:

1.	Director-Professor	1
2.	Professor	1
3.	Additional Professor	1
4.	Associate Professor	1
5.	Assistant Professors	2
6.	Senior Lecturers	2
7.	Lecturers	2
8.	Tutors	4
9.	Stenographers	2
10.	Technicians	12
11.	Clerk	1
12.	Glass Blower	1
13.	Museum Curator	1

7.	Registrars	3
8.	Stenographers	2
9.	Technicians	4
10.	Clerk	1
11.	Class IV staff	9

OPHTHALMOLOGY

The staff of this department should consist of the following:

1.	Professor	1
2.	Associate Professor	1
3.	Assistant Professor	1
4.	Senior Lecturers	2
5.	Lecturers	2
6.	Registrars	2
7.	Stenographer	1
8.	Technicians	2
9.	Clerk	1
10.	Class IV staff	2

E. N. T.

The staff should consist of the following:

1.	Professor	1
2.	Assistant Professor	1
3.	Senior Lecturer	1
4.	Lecturer	1
5.	Registrars	2
6.	Stenographer	1
7.	Technicians	2
8.	Clerks	2
9.	Class IV staff	2

RADIOLOGY

This Department should be divided into two separate sections and the staff should consist of the following:

Radio-Diagnosis

1.	Professor	1
2.	Assistant Professor	1
3.	Senior Lecturers	2
4.	Lecturers	2
5.	Tutors	6

Radiotherapy

1.	Professor	1
2.	Assistant Professor	1
3.	Senior Lecturer	1
4.	Lecturer	1
5.	Tutors	2
6.	Stenographers	2
7.	Technicians	8
8.	Clerks	2
9.	Class IV staff	10

ANAESTHESIOLOGY

This department has to work with several specialist units including general surgeons. The staff should consist of the following:

1.	Professor	1
2.	Associate Professor	1
3.	Assistant Professors	3
4.	Senior Lecturers	3
5.	Lecturers	3
6.	Tutors	10
7.	Stenographer	1
8.	Technicians	2
9.	Clerk	1
10.	Class IV staff	10

PATHOLOGY

The staff should consist of the following:

1.	Director-Professor	1
2.	Professor	1
3.	Additional Professor	1
4.	Associate Professor	1
5.	Assistant Professors	2
6.	Senior Lecturers	2
7.	Lecturers	2
8.	Tutors	4
9.	Stenographers	2
10.	Technicians	12
11.	Clerk	1
12.	Glass Blower	1
13.	Museum Curator	1

7.	Registrars	3
8.	Stenographers	2
9.	Technicians	4
10.	Clerk	1
11.	Class IV staff	9

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The staff of this department should consist of the following:

1.	Professor	1
2.	Associate Professor	1
3.	Assistant Professor	1
4.	Senior Lecturers	2
5.	Lecturers	2
6.	Registrars	2
7.	Stenographer	1
8.	Technicians	2
9.	Clerk	1
10.	Class IV staff	2

E. N. T.

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1.	Professor	1
2.	Assistant Professor	1
3.	Senior Lecturer	1
4.	Lecturer	1
5.	Registrars	2
6.	Stenographer	1
7.	Technicians	2
8.	Clerks	2
9.	Class IV staff	2

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This Department should be divided into two separate sections and the staff should consist of the following:

Radio-Diagnosis

1.	Professor	1
2.	Assistant Professor	1
3.	Senior Lecturers	2
4.	Lecturers	2
5.	Tutors	6

6.	Stenographer	1
7.	Technicians	2
8.	Clerk	1
9.	Class IV staff	2

EXPERIMENTAL MEDICINE

The staff should consist of the following:

1.	Professor	1
2.	Associate Professor	1
3.	Assistant Professors	2
4.	Senior Lecturers	2
5.	Lecturers	2
6.	Tutors	2
7.	Stenographer	1
8.	Technicians	6
9.	Clerk	1
10.	Class IV staff	8

DENTISTRY

The staff should consist of the following:

1.	Professor	1
2.	Assistant Professor	1
3.	Senior Lecturer	1
4.	Lecturer	1
5.	Tutors	2
6.	Stenographer	1
7.	Technicians	2
8.	Dental Mechanics	2
9.	Dental Hygienists	2
10.	Class IV staff	4

ANATOMY

1.	Professor	1
2.	Assistant Professor	1
3.	Senior Lecturer	1
4.	Lecturer	1
5.	Tutors	2
6.	Stenographer	1
7.	Technicians	2

14.	Animal Keeper	1
15.	Class IV staff	10

MICROBIOLOGY (BACTERIOLOGY & VIROLOGY)

The staff should consist of the following:

1.	Director-Professor	1
2.	Professors	2
3.	Additional Professor	1
4.	Associate Professsor	1
5.	Assistant Professors	2
6.	Senior Lecturers	2
7.	Lecturers	3
8.	Tutors	4
9.	Stenographers	3
10.	Technicians	16
11.	Clerk	1
12.	Class IV staff	14

BIOCHEMISTRY

The staff should consist of the following:

1.	Professor	1
2.	Additional Professor	1
3.	Associate Professor	1
4.	Assistant Professors	3
5.	Senior Lecturers	2
6.	Lecturers	2
7.	Tutors	3
8.	Stenographer	1
9.	Technicians	8
10.	Clerk	1
11.	Class IV staff	8

BIOPHYSICS

The staff should consist of the following:

1.	Professor	1
2.	Assistant Professor	1
3.	Senior Lecturer	1
4.	Lecturer	1
5.	Tutors	2

ORGANISATIONAL PATTERN OF POSTGRADUATE MEDICAL EDUCATION

K. N. RAO

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THE subject-matter of the First World Medical Education Conference was "The Philosophy of the First Rate as the Objective of Undergraduate Medical Education," that of the second "Medicine as a Life-long Study." The Third World Medical Education Conference which is proposed to be held in New Delhi in 1966 would discuss "Medical Education—A Factor in Socio-Economic Development" or, in other words, "Medicine in the Service of Mankind."

Postgraduate medical education comprehends (a) medical education of the graduate after full registration, (b) acquiring qualification either for a diploma or a degree enabling the practitioner for specialisation, and (c) continuing education either for a general practitioner or for a specialist.

The aims of postgraduate medical education are to train generalists and specialists to render a high standard of medical care; to produce competent teachers for the rapidly increasing medical institutes, and research workers to do fundamental and applied research; and finally to provide continuing education.

PRESENT POSITION IN INDIA

Medical education in India is regulated by the Indian Medical Council Act of 1956, as amended in 1964. Postgraduate medical education is regulated by the Postgraduate Committee of the Medical Council of India.

At present, there are 80 medical colleges with an annual admission of 10,000 students for undergraduate medical education. A great majority (65) of the medical colleges are run by the government and the rest either by local bodies (4), universities (4), voluntary organisations (4), or by Christian Missions (3). The voluntary organisations depend for hospital facilities on the government hospitals. In the field of clinical sciences, the hospital is an integral part of the medical college. With the increase in the number of admissions, there has been no corresponding increase in the teaching hospital beds, and this requires immediate attention.

Besides the All India Institute of Medical Sciences, about 56 medical centres affiliated to about 32 universities are offering postgraduate studies. The establishment of the All India Institute of Medical Sciences was recommended by the Bhore Committee. It was started in New Delhi in 1956 as an autonomous institution responsible for setting up effective patterns of education, both undergraduate and postgraduate, in all health sciences. This Institute has accomplished great many things in providing the patterns of education. The Health Survey and Planning Committee recommended the establishment of six more centres at Calcutta,

8.	Clerk	1
9.	Modeller	1
10.	Museum Keeper	1
11.	Bone Keeper	1
12.	Embalmer	1
13.	Class IV staff	7

PHYSIOLOGY

1.	Professor	1
2.	Assistant Professor	1
3.	Senior Lecturer	1
4.	Lecturer	1
5.	Tutors	2
6.	Stenographer	1
7.	Technicians	3
8.	Clerk	1
9.	Class IV staff	5

PHARMACOLOGY

1.	Professor	1
2.	Assistant Professor	1
3.	Senior Lecturer	1
4.	Lecturer	1
5.	Tutors	2
6.	Stenogragher	1
7.	Technicians	3
8.	Clerk	1
9.	Class IV staff	5

POSTGRADUATE EDUCATION IN BASIC MEDICAL SCIENCES, CLINICAL SCIENCES AND PUBLIC HEALTH

Postgraduate medical education for qualification may be considered under the following heads:

Basic Medical Sciences (Anatomy, Physiology, Biochemistry, Pathology, Microbiology, Pharmacology, etc.). In-service training in departments of medical colleges and other specialised institutions should be organised. In order to attract medical graduates, training posts should be offered with incentives. They should have teaching opportunities while working as demonstrators or tutors or fellows. Non-medical scientists' programme should also be organised as recommended by the Health Survey and Planning Committee.

Clinical Sciences. In clinical sciences, training will have to be given in hospitals where laboratory, diagnostic and experimental facilities are available as also suitable teachers. The subjects in which postgraduate training facilities have to be given are: general medicine, general surgery, obstetrics and gynaecology, paediatrics, and in specialities, such as ophthalmology, E.N.T. diseases, orthopaedics, cardiology, neurology, dermatology, radiology, anaesthesiology, etc. The training should consist of clinical training in the hospitals, regular systematic courses, conferences and seminars, and graded responsibility for patient care. The period of training should be extended to four years after full registration.

Postgraduate Education in Public Health and Social Medicine. There is need for public health qualified teachers, either D.P.H., M.D. or Ph.D., for administrative, teaching and research posts. Inducements should be offered to this group as the country needs a large number of qualified personnel.

CONTINUING EDUCATION

The continuing education of physicians, both generalists and specialists, is one of the most pressing problems facing medical education today throughout the world. Successful attempts have been made and are being made in the U.S.A., the U.K., the U.S.S.R. and other developed countries. In India, specialist organisations and medical associations have paid attention to this problem but much remains to be done. There is a necessity for a nation-wide "university without walls" for the continuing medical education. Every regional hospital centre and medical college should take up this work besides the two Colleges of General Practitioners functioning at Hyderabad and Delhi. The proposed Indian Postgraduate Medical Federation and the National Committee should formulate policies and encourage every Regional Committee in each State to work out local programmes. This would, with the advances in science and technology, greatly raise the standard of medical care in the country and the knowledge of the physicians.

TRENDS IN U.K., U.S.A., U.S.S.R. AND AUSTRALIA

In the United Kingdom, till recently, the clinical training for postgraduates had received less attention, possibly because the over-emphasis on the needs of the undergraduate

Madras, Chandigarh, Hyderabad, Bombay and Lucknow. The government have declared the Medical College at Pondicherry as the Jawaharlal Institute of Postgraduate Medical Education and Research. The Institutes at Calcutta and Chandigarh are in the process of development as Postgraduate Medical Schools on the Hammersmith model. Other centres at Hyderabad, Bombay, Madras and Lucknow require reorganisation and further development.

The enrolment in 1963-64 for postgraduate study and research in both basic medical and clinical sciences was about 2,335 (1963) for the two-year degree courses, i.e. an annual admission of about 1,200 and 1,873 (1963) for diploma courses.

The general pattern of training for postgraduate qualifications is two years for degree course and one year for diploma course after one year of housemanship following full registration.

In the field of postgraduate medical education in clinical sciences, both in the graduate, postgraduate and continuing phases, the hospital is the basic component and should therefore be of the requisite standard to give proper training to the generalists and specialists. The present training facilities, being inadequate, in the teaching and non-teaching hospitals require our serious attention.

Clinical Training of Compulsory Housemen. Under the revised curriculum for M.B.B.S., internship has been replaced by compulsory housemanship (rotating) for a period of 12 months in an approved hospital or work in the Defence Medical Services or in any other medical institution recognised for this purpose. The student is required to undergo training for a period of 3 months each in medicine, in surgery, in obstetrics and gynaecology and in public health. The present arrangements are not satisfactory; nor is the supervision adequate. There is need for the organisation of a regular training programme. At present, about 10,000 students are being admitted to medical colleges, and from 1967, about 10,000 housemen would require placements annually.

Clinical Training Programmes for House Surgeons and Residents (Postgraduates). At least 5,000 doctors would take Senior House Surgeon's training to qualify for selection to the postgraduate diploma or degree courses. Even after the compulsory housemanship, the future generalist still requires further House Officer's training. Suitable arrangements are, therefore, necessary in the various teaching and non-teaching hospitals, not only for teaching purposes but also for providing amenities, such as library, clinical conference rooms, X-ray and radiological services, etc.

Residencies. About 2,500 postgraduates are expected to be enrolled to undergo clinical training for a period of one to two years. At any one time, therefore, there would be about 7,500 trainees. The present postgraduate training facilities are far from satisfactory because in-service training and patient care are not insisted upon. The quality of our specialists could only improve should residency pattern of training be given to our postgraduate students.

It is, therefore, of urgent and immediate concern for the present and future of the health services of the country that facilities for education in the hospitals should be radically improved.

(b) It is important to promote an educational atmosphere in the whole system which would form the regional hospital service. Senior staff and junior staff should find time to devote themselves to education.

(c) In each of these hospitals or hospital groups, a consultant should be nominated by the authorities for postgraduate education as clinical director, responsible for teaching arrangements and general care of those under training. He should have administrative support and adequate secretarial assistance.

(d) The clinical director should, in consultation with the general practitioners in the area, create facilities for them to participate in clinical discussions and in clinico-pathological conferences. They should also have access to the library and to the diagnostic department for consultation.

(e) Certain physical facilities, such as the following, are necessary in each hospital:
   (i) Seminar Room
   (ii) Library
   (iii) Clinical Director's office
   (iv) Laboratories adjacent to the wards in which trainees can perform tests and investigate their patients
   (v) Married quarters for junior hospital staff to enable them to live in the premises of the hospitals
   (vi) Lunch room as a focal point where hospital medical staff can meet general practitioners

(f) Certain criteria should be developed to create standards relating to:
   (i) Standard of supervision
   (ii) Quantity and variety of clinical material
   (iii) Standard of records
   (iv) Postmortem service
   (v) X-ray and pathological services
   (vi) Laboratory facilities
   (vii) Seminars, clinico-pathological conferences, etc.

Postgraduate medical education should, therefore, be organised as a regional scheme in which all hospital units are the basic elements, and they must be in association with the regional university or faculty of an all-India medical centre. As such, the hospitals have to be upgraded to meet the training requirements of interns, housemen and residents (postgraduates). This is a matter of great urgency if we want to train proper general practitioners, specialists, teachers and investigators for the future, according to the minimum international standards.

NATIONAL AND REGIONAL COMMITTEES ON POSTGRADUATE EDUCATION IN MEDICINE AND ALLIED SCIENCES

National Committee. In order to achieve the above, a National Committee for Higher Education in Medicine and Allied Sciences for the formulation of principles of policy was

education tended to obscure the equally pressing question of postgraduate education. The problem of men and women doctors holding training posts in hospitals, and not obtaining the required facilities for such training because of lack of organisation, is at present one of the major problems in the United Kingdom. The minimum requirements of postgraduate training posts can only be obtained in hospitals when there is an organisation to handle it. In the U.K., the British Postgraduate Medical Federation in London has done yeoman service in the organisation of postgraduate medical education.

In the U.S.A., great emphasis is laid on the training of clinical postgraduates by a Residency type in-patient care under supervision. The hospitals, big and small, teaching and non-teaching, are accredited by the American Hospital Association and the Council on Medical Education and Teaching Hospitals of A.M.A., only when they conform to the minimum standards. The American Boards have done much in the last few years towards the organisation of graduate and postgraduate education of specialists.

In the U.S.S.R., most of the city hospitals are used for teaching, which enables them to admit a large number of clinical undergraduates and postgraduates.

In Australia, the Australian Postgraduate Medical Federation at the national level and the Postgraduate Medical Committees at the State level have contributed much toward the organisation of postgraduate eduction in the Commonwealth of Australia and New Zealand.

SUGGESTED PATTERN OF ORGANISATION

Organisation of clinical postgraduate medical education in India is important to the people and to the doctors who require training in order to provide better specialist care to our population. Arrangements should be made to enable as many doctors as possible to have postgraduate medical education and training in India not only while they occupy training posts in hospitals, such as House Surgeoncy and Residency training for the postgraduate courses of M.D., M.S. or diploma courses, but also during the period of their continuing education. With the pace of advancement of medical and scientific knowledge, postgraduate education has become more important now. As medicine is a life-long study, postgraduate education has to supplement the undergraduate education. This should continue even after service in training posts is ended, and include arrangements to allow not only trainees but also doctors from all branches of the medical profession to have access to reference libraries and discussion groups.

There is a need to establish Regional Hospital Boards in the different areas around medical centres not only to organise better hospital services but also for better training facilities to our future practitioners and specialists. There is, thus, a necessity to recognise certain posts as training posts in all hospitals which should satisfy the above requirements so that a large number of would-be specialists could get training. In order to achieve this, not only the Regional Postgraduate Unit but also the District Hospital or a group of hospitals should become teaching centres fulfilling the following requirements:

(a) All consultants should recognise their responsibility in the training of junior staff. They should regard this as one of the most important aspects of their work.

SPECIALISED HOSPITAL-INSTITUTES OR UNITS IN HOSPITAL

In large centres like Delhi, Bombay, Calcutta, Madras and Hyderabad, where there are specialised hospitals, there is need for establishing institutes in association with the specialist hospitals, e.g. Institute of Orthopaedics, Institute of Child Health, Institute of Laryngology and Otology, Institute of Diseases of the Chest, Institute of Dermatology, Institute of Cardiology, Institute of Urology, Institute of Dental Surgery, Institute of Neurology, Institute of Psychiatry, etc.

In smaller centres, where there are no specialised hospitals, specialist units or departments should be established and postgraduate education should be co-ordinated in co-operation with all the units.

NATIONAL EXAMINATIONS

In view of lack of uniformity of standards of examinations in the various universities, the Postgraduate Committee and the Medical Council of India have recommended that national examinations be conducted by a statutory body. The Indian Academy of Medical Sciences has come forward with a scheme for training specialists and holding national examinations for their membership qualification. The Special Committee appointed by the Central Council of Health under the chairmanship of Dr. A. L. Mudaliar, Vice-Chancellor, Madras University, for the enforcement of uniform standards of postgraduate qualifications, has recommended national examinations to be conducted by an academy statutorily constituted. The Indian Association for the Advancement of Medical Education should attach great importance to this recommendation to improve the standards of our postgraduate education.

SUMMARY

The aims of postgraduate medical education are to train generalists and specialists to render a high standard of medical care, competent teachers for the rapidly increasing teaching institutions and research workers to do fundamental and applied research for the solution of health problems, besides providing continuing education for the generalists and the specialists.

In the field of clinical sciences, the hospital is an integral part of the medical college. With the increase in the number of admissions, there has been no corresponding increase in the teaching hospital beds and this requires our immediate attention. The hospital is the basic component in the training in clinical sciences and should be of the requisite standard to give proper training to the future generalists and specialists. The present training facilities in the teaching and non-teaching hospitals are inadequate.

In the field of clinical training of Compulsory Housemen, the present arrangements are unsatisfactory and there is need for the organisation of a regular training programme. Even after compulsory housemanship, the future generalists would require further House Officers' training. Suitable arrangements are, therefore, necessary in the various teaching and non-teaching hospitals, not only for teaching purposes but also for providing amenities like library,

constituted by the Health Ministry in 1963 with the following members:

1. Minister for Health
2. Secretary, Ministry of Health
3. Director General of Health Services
4. A member of the University Grants Commission
5. A representative of the University
6. President, Medical Council of India
7. A representative of the All India Institute of Medical Sciences
8. A representative of the Indian Academy of Medical Sciences
9. Representatives of the Regional Hospitals
10. Representatives of the Colleges of General Practitioners or the President of the Indian Medical Association
11. Co-opted members (professionals and members of the professional associations)

This committee considers the over-all man-power requirements of physicians, specialists, etc. and the action to be taken for obtaining them.

Regional Committee. There is now a necessity for the constitution of regional bodies, one for each State, to serve as the Postgraduate Medical Committee, comprising the State Health Minister, University representatives, Director of Health Services, Regional Hospitals' representatives, Deans or Principals of Medical Colleges, representatives of College of General Practitioners or associations and co-opted members interested in postgraduate education.

These committees should co-ordinate the activities of the various elements responsible for postgraduate medical education in clinical sciences and should also decide the responsibility of the various authorities. With proper co-ordinated work of the National and Regional Committees, uniform development of facilities for such training throughout the country would become a reality.

There should be a postgraduate Dean or Chairman appointed from the faculty of the medical centre, concerned with the following responsibilities:

1. Inter-relationship between the region and university and the college
2. Arrangements for teaching and training in the region
3. Advising on careers to the young doctors so that their future careers may be planned
4. Advising and placing of students from other States or areas
5. Integration of general practitioners and specialists outside the services into these postgraduate arrangements.

In view of the need for a large number of teachers and specialists required for Health Services and for providing opportunities for the large number of postgraduates who proceed to the U.K. or the U.S.A. for want of facilities in India, this is all the more urgent.

A REVIEW OF POST-BASIC AND POSTGRADUATE TRAINING OF NURSES

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NURSES and those concerned with nursing services are increasingly conscious of the fact that the basic course which prepares nurses for first-level positions is not sufficient for positions of responsibility or those requiring special skill and knowlege. This is partly due to developments in medical science which call for corresponding developments in nursing skills and partly to the growing complexity of administrative routine in hospitals. Social changes today have led to new needs of patients, their relatives and friends. The basic course now includes a greater content of sciences basic to nursing and principles of nursing care, but further formal training, built on experience subsequent to the basic training, is essential to equip the nurse for fulfilling newer functions.

The Second World War greatly accelerated the change that was taking place gradually in the pattern of nursing and the rapid growth in all directions in our country after Independence has increased further the rate and range of change. I would include in this the growth of unemployment which has brought pressure on many nurses to take a major share in the support of the family; sometimes even an auxiliary nurse-midwife is the only earning member. One can understand therefore the scramble for the few opportunities for promotion and the anxiety to know if a course will "count" towards promotion. One may deplore this tendency but it will persist until economic conditions improve. And it is being taken into account—not with a view to fostering it—when planning our post-basic programmes.

There are four formal courses being given at present other than in special clinical fields. These are: Nursing Administration, Nursing Tutor, Midwifery Tutor, and Public Health Nursing. The administration and nursing tutor courses were started between 1942 and 1944 in Vellore, Delhi and Madras; the midwifery tutor course was started in Delhi in 1956. The curriculum for these courses has been amended and adjusted over the years. Many of the subjects are common to all the three courses, particularly, principles of teaching and administration and 10 hours of teaching practice. It is good for all matrons to learn how to teach and for all teachers to learn about administration. In Delhi, in addition to field observation, the students are sent for one month to different hospitals where there is a good nursing school or the opportunity to see good administration. The student-tutors give a minimum of 20 classes supervised by the hospital tutor; the administration students are assigned the detailed study of problems in various administrative fields. When they return to college, seminars are arranged so that the entire group can share experiences with one another and work together on actual life problems in the fields of nursing administration and teaching. The duration of the courses is 10 months but the midwifery tutors course has been extended by one more month to provide experience in domiciliary midwifery which many of the students

clinical conference rooms, X-ray and radiologieal services, etc.

In order to improve the quality of our specialists, it is very necessary to give residency pattern of training to our postgraduates. To achieve this end, facilities for education in the hospitals should be radically improved.

Under basic medical sciences, in-service training should be organised and training posts should be offered to attract medical graduates.

In clinical sciences, training should be given in hospitals where laboratory, diagnostic and experimental facilities exist and suitable teachers are available.

Inducements should be offered to attract postgraduates to take up public health and social medicine where there is a need for a large number of qualified personnel.

There is a necessity to create a nation-wide "university without walls" for the continuing medical education.

Postgraduate medical education and training have received great attention in the U.K., the U.S.A., the U.S.S.R., and Australia but not much in this country.

Arrangements should be made to enable as many doctors as possible to have postgraduate medical education and training in India not only while they occupy training posts in hospitals but also during their continuing education. There is need to establish Regional Hospital Boards in the different areas around medical centres and recognise certain posts in the hospitals as training posts. The hospitals should fulfil certain essential requirements and should have facilities like seminar room, library, laboratory, lunch room, etc.

Postgraduate medieal education should be organised as a regional scheme in which all hospital units are the basic elements. The hospitals should be upgraded to meet the training requirements of interns, housemen and residents (postgraduates).

The National Committee for Higher Education in Medicine and Allied Sciences functioning in the Ministry of Health may form the governing body of the proposed Indian Postgraduate Medical Federation.

There should be regional Postgraduate Medical Committees for each State to co-ordinate the activities of the various elements responsible for postgraduate medical education in clinical sciences and also decide the responsibility between the various authorities.

There is need for establishing institutes in association with specialised hospitals in large centres like Madras, Bombay, Calcutta, Hyderabad and New Delhi. In smallar centres, where there are no specialised hospitals, specialised units or departments should be established in the medical college hospitals.

The question of organisation of national examinations by a statutory body to attain uniformity in standards of examinations in the universities deserves serious consideration.

for a B.Sc. degree, an exemption of one year being allowed for the nursing certificate. For the present, the courses are given only for nursing administration and education, including public health nursing, but it is proposed that specialised courses be established to cover five broad fields, namely, medical and surgical nursing, maternal and child health, midwifery, psychiatric nursing, and public health nursing. Specialisation in various clinical fields could be covered in medical and surgical nursing and paediatric nursing could be included in the broader field of maternal and child health or it might be the subject of a special course.

The importance of clinical specialisation should not be underestimated. The question is: should there be formal courses for every special field with all the accessories of conditions for recognition, examination rules? Formal teaching is necessary to give depth in physiology, to give a better grounding in psychology and sociology, to teach the student how to express herself lucidly and logically. This can be done in the broad fields mentioned earlier. But no formal course can replace the experience and competence gained by working under the guidance of a specialist and an experienced ward sister, that is to say, learning from close observation and day-to-day care of patients. I hope that value will be laid increasingly, both by the nurse and by her employers, on this type of specialisation supplementing the formal course in a broader field. Monetary incentives are important in developing this programme, but even more important would be the recognition given to the concept that there is scope in nursing to develop such competence and that such nursing is essential for the effective application of medical science.

The association of post-basic nursing programmes with educational rather than service institutions is encouraging and one may expect that future developments will take place increasingly within universities. The problem is to find good teachers. In common with other disciplines we look for the inspired teachers, the nurse imbued with an enthusiasm for nursing and with a close interest in the students and faith in their capacity to respond to a learning situation. Teaching post-basic students is rewarding work. Most of them are serious students, some of them desperately anxious to make the grade because of various pressures which often inhibit their capacity to learn. Some of them feel insecure. It is the task of the teacher to teach them to learn and build up their confidence. She finds her reward in watching them blossom out as they progress in their course. Hitherto we have relied heavily on foreign nurses to provide such teaching, but the courses which they have helped to set up are beginning to produce the teachers we need.

What is the goal of these educational programmes? In the preface to a manual on post-basic nursing education prepared by the International Council of Nurses, the writer, Mr. Brech, said: "The greatness of man's technological attainments can hardly be gainsaid. What remains open to question is the benefit that he himself will draw from them." The Nuffield Report had made a disturbing remark that "the end result of nurse-training for the hospital service is not nursing but administration." Fears have been expressed that the end result of nursing education may be to lead nurses away from nursing. I do not think so. I think that with a greater understanding of the factors that contribute to health and disease, with opportunities to experience the satisfaction of doing good nursing, nurses will see more meaning in their work and will perceive the scope for extending nursing knowledge and developing and perfecting skills. The end result will be good nursing.

have not had in the past. This will not be necessary when all schools for the basic midwifery course are able to give experience of domiciliary work.

There has been a growing need for training for the Ward Sister in ward management and clinical teaching. Long experience and traditional discipline, which served very well in the past in the efficient management of a hospital ward, were either not available or not sufficient. Formal training in the principles of administration and its practical application was necessary to supplement experience and what remained of traditional discipline had to be sustained by an understanding of inter-personal relationships. This thinking was the basis for the introduction of a 3-month course in ward management and for making this course a basic requirement for the administration and teaching courses. As a part of their field work the students undertake full nursing care of at least one patient and it is pleasing to find that the nurses take great pleasure and interest in this assignment as they get both time and enough equipment to nurse a patient as he should be nursed.

These courses have served the needs of hospitals and nursing schools but nursing cannot fulfil its function wholly within hospital walls. Therefore to meet community needs a course in public health nursing was started in 1952 at the College of Nursing, Delhi, which was moved the following year to the All India Institute of Hygiene and Public Health, Calcutta. We were sorry to see the Course taken out of a Nursing College but the move proved to be very beneficial, as, in the Institute, the public health nursing teachers and students have the opportunity to work and learn with teachers and students of other public health disciplines which they missed in Delhi. This has been of the greatest value to the nurses, particularly in the formative years when the curriculum was being developed. In the beginning, this course, though post-basic, really gave basic preparation, for the students had little or no experience of public health nursing. But, now that nurses are working in primary health centres, at least two of the schools in the States *are making* experience of public health nursing a requirement for admission, so that what began as a basic preparation in public health nursing is now taking on the true character of a post-basic course, building on the previous knowledge and experience of the student. A short course in Supervision for Public Health Nurses has also been established at the All India Institute of Hygiene and Public Health.

A course for a Master of Nursing degree was established by the University of Delhi in 1959. This course gives preparation in nursing education and nursing administration, including public health for nurses who have a B.Sc. degree in nursing. The first year covers courses in psychology, the philosophy and sociology of education and its principles and practice. The students do 50 hours of supervised practice teaching, four-fifths of which is in the field related to their chosen speciality, and also two months of field work. The second year is concentrated more on nursing subjects and therefore the accent is on the methodology of studying nursing problems and on the research on the problems of nursing.

Post-basic courses have also been started in two clinical fields: psychiatric nursing and paediatric nursing. What should be the future development of these courses, what type of further training and learning is needed, is a matter for serious consideration and I believe it is linked with the recent and, as I would call it, exciting event for nurses, the establishment of post-basic courses for nurses by the universities of Kerala and Punjab. These are two-year courses

corporate the principles and practice of educational philosophy to the betterment of medical education.

In view of the rapid advance in sciences which have a bearing on medicine and also in view of the advances made in the philosophy of education, the need for teacher training is stronger today than it was felt in the past. To take an example, unless a teacher knows enough of molecular biology or enough of physics and electronics, he will never be able to raise questions of a fundamental nature during his teaching, and therefore the students' genuine interest may never be roused.

Further, if we agree that in a good teaching programme the student must be helped to *wanting to learn* rather than just to know; if we accept the principle that knowledge and learning are different, that there is a large body which emphasises facts, that learning is very personal, that to concentrate upon facts arbitrarily selected as cold and bloodless is refusing to see their real worth, and if we further accept that learning requires freedom, that traditional teaching where the teacher preaches and the student responds is relatively easy, and if we also concede that real teaching is concerned with helping the student to want to learn rather than to know and that it involves an honest effort to understand the student rather than to judge him, we will immediately concede that teaching is a very specialised and difficult assignment.

The sooner, therefore, we realise that teaching is a speciality like any other and that the quality of teaching can improve immensely by training, the better for us.

A MODEL PLAN

A definitive attempt to train the faculty was undertaken by the Graduate School of Medicine, University of Pennsylvania, under the direction of Dr. J. Comroe, JR., M.D. A course was devised for training people who were already teachers in various medical schools. The course was divided into three trimesters and attempted to cover the following topics:

The first trimester was devoted to statistics and mathematics as applied to medicine. Calculus was covered including differential equations and partial differential equations. The fundamentals of statistical theory, its usefulness and limitations, were discussed. Design of experiments was briefly touched upon. The use of calculating machines was encouraged. Critical evaluation of medical literature was also undertaken.

The second trimester. The subjects covered were medical physics, chemistry and physical chemistry as applied to medical research. Emphasis was again on principles rather than on operating details. Some of the topics dealt with were states of matter, separation and identification of gases, dynamic analysis, theromodynamics, chemical kinetics, radiation physics, electronics, photometry, spectrophotometry, microscopy, fluid mechanics, separation and identification of ions and molecules in liquid state.

The third trimester was devoted to the art and science of medical teaching, medical writing, medical administration and critical evaluation of literature.

As part of the practical teacher training, each member of the group had to give a lecture which was critically evaluated on several points by the remaining group. The talk was tape recorded, so that the speaker could later play it back and listen to it in the light of the criticism

TEACHER TRAINING AS PART OF POSTGRADUATE MEDICAL EDUCATION

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IN the recent past there has been considerable rethinking, experimentation and reorganisation of the various aspects of medical education in several leading universities in the West. In our country in recent years, there has been an acute awareness of the shortcomings, and problems of medical education are receiving serious attention. It is therefore time to emphasise an aspect of medical education which is not receiving adequate attention and which, if neglected, will lead to a lopsided improvement and reorganisation of medical education.

The field of medical education embraces four major areas:

1. The syllabus and the curricular reorganisation.
2. Problems relating to transition from the pre-medical to medical training.
3. The selection of prospective students.
4. Factors that characterise medical students and medical school.

It is not the purpose of the present paper to discuss the various "teacher characteristics" or to define the dimensions of the teaching process. I only wish to emphasise that the teacher is a very important link in the "teaching-learning" processes and must receive due attention for any good medical education programme to succeed. To put it in the words of Dr. G. Miller: "... in the midst of this upheaval one segment of the complex programme has largely escaped either systematic study or change. This is the teacher. Almost alone, the University of Buffalo Project in Medical Education has focussed attention on the preparation and role of the medical school instructor in the belief that the keystone in the education arch should not be overlooked."

THE NEED FOR TEACHER TRAINING

It must be granted that members of a medical faculty come to their teaching roles well groomed as physicians or scientists. But they have had no preparation except knowledge of the subject matter for the task of instruction. It is also well known that investigators or physicians of great eminence may be unable to communicate with their students and this leads to a failure of the implementation of a teaching programme, however sound. It is well known, again, that there is no correlation between the skill of a person as a teacher and the amount of information he possesses. If the fund of knowledge and teaching skill cannot be equated it seems reasonable to improve their efficiency in teaching by a study of the learning process.

It must, therefore, be conceded that mere acquiring of a degree is not preparation enough for the heavy responsibility of teaching. It is therefore our ressonsibility as educators to in-

Cadre of Medical Educators. It will, I hope, meet to a great extent the acutely felt want of proper teaching personnel who are devoted to teaching and training.

The proposal, though sound, may not find favour with many medical faculties. Such a response is based more upon emotion than upon reason. It is linked more to the problem of our unwillingness to break the established traditions and to accept new values. We need not be allergic to the idea of teacher training or the idea of an M.D. or M.S. taking courses in instruction teachnique and philosophy. We appreciate an M.A. or M.Sc. candidate having to acquire a 'bachelor' or 'master' degree in education, we do not mind a B.A. or M.A. going for I.A.S. training. We view with equanimity an I.A.S. going for training in public administration or public accounts. Why should we resist the idea of a medical man taking training to become a more efficient teacher ?

If we have to adequately cater to the academic and emotional teaching needs of a large number of new medical colleges, if we desire to have standards of education and research as good as any in the world, we cannot shelve this aspect of medical education. The problem must engage our serious attention.

In conclusion, I would plead that we must keep our minds open, and in spite of difficulties and limitations, we should set in motion measures to improve the quality of teaching. After all a medical school is only as good as its faculty.

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offered. The tape recording also provided an opportunity for the individual to compare his subsequent performances.

An interesting part of this programme was that every speaker had to give a talk during which he was interrupted repeatedly with questions. It helped to train the mind to keep the continuity of thought in spite of distraction.

Another significant and, to my mind, very important part of the teaching programme was the instruction in the art of conducting seminars. This is very different from giving a formal lecture. It is much more difficult and requires much more skill on the part of the chairman. Each member of the group had to conduct a seminar on a topic of his own choice.

At the end of most of these talks very useful suggestions were offered regarding how the contents could have been reorganised or how visual aids could have been improved. It was revealing how much life can be put in the same talk when managed by a master mind.

A course in medical writing comprised two seminars on the use and abuse of words. Then the members of the group corrected some papers submitted for publication. Subsequently, they had to write some articles of their own which were critically commented upon and rewritten.

Critical Evaluation of Medical Literature. Interspersed throughout the course were sessions on critical evaluation of medical literature. Articles selected from classic and less distinguished medical literature were assigned for critical analysis of style, content, design of experiment, validity of conclusions, etc. These seminars were conducted by mature investigators.

At the end of the basic course of three trimesters, arrangement was made for every individual to have a period of intensive training in his chosen speciality.

I have reported this course in some detail so that a similar course may be fashioned keeping this model in mind.

The purpose of such a course is to fill a definite place in medical education. There could be some argument regarding the content and organisation of such a programme. It should be conceded that the course may have to be modified to suit local resource and requirements.

TWO QUESTIONS

We must now examine two vital questions:

(a) Where can such a faculty training programme be started ?
(b) Will it attract students ?

A course patterned after the one outlined can definitely be started at the older universities and medical colleges like Calcutta, Bombay, Madras, and Delhi. Given the will it is not difficult to have the necessary pool of talent in medical and allied sciences to organise such a course.

Such a training programme will attract students if we raise teaching to the level of a speciality and give the candidate so trained the necessary status and financial rewards There should be no difficulty in considering the training as a speciality when we see that the person spends two years in intensive formal training and investigation as required by other specialities. It will help establish a uniform standard of teaching throughout the country and create an All India

medical and clinical departments so that better opportunities are available to the candidates for proper training and experience.

Therefore, while expanding a department to undertake postgraduate training, attention should also be given to the overall development of other related departments (pre- and para-clinical).

Recommendation No. 6. In order to organise better hospital services which in turn would provide better training facilities to the postgraduate students, the postgraduate unit should co-ordinate a service and training programme with approved district hospitals within the region.

Recommendation No 7. Though postgraduate candidates will be mainly working in their respective specialities, a few of them might like to continue advanced research in the subject of their choice. Hence research workers should be encouraged and developed as a part of post-graduate studies.

In order to provide academic recognition to such workers, they may be given the opportunity to register for the Ph.D. degree.

Recommendation No. 8. To provide uniform standards of examination, the Conference recommended the establishment of a Central Board to conduct examinations at 4-5 centres in rotation. Only such institutions as are approved by the Central Board should be centres of examinations.

Recommendation No. 9. Since teaching of the speciality may constitute one of the important activities undertaken by the postgraduate students, it was felt that all postgraduate students should be given suitable opportunities to learn about principles and methods of teaching. They should also be given, it was pointed out, adequate opportunities for teaching.

Recommendation No. 10. In view of the demand for trained nurses to work in various specialities, it was thought that graduate and postgraduate training facilities should be given to nurses, wherever possible, through the universities.

REPORT ON GENERAL PRINCIPLES OF POSTGRADUATE MEDICAL EDUCATION

BY

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THE 5th Annual Conference of the Indian Association for Advancement of Medical Education reviewed the general principles of postgraduate medical education and emphasised that the following should constitute the three basic principles for organising postgraduate medical education in India: (1) training of medical graduates in various surgical specialities; (2) training in proper research methods; (3) recruitment of properly qualified and trained teachers.

The following are the main points which arose out of the discussion on the first day of the seminar on postgraduate medical education.

Recommendation No. 1. In selecting postgraduate students academic proficiency should constitute only one of the many criteria for selection. The observations made by the staff members in respect of candidates' aptitudes, powers of observation and expression should be taken into account.

Suitable yardsticks must be developed for objective assessment of the candidates during their housemanship and internship.

Recommendation No. 2. There is a need to maintain a high standard of training at the postgraduate level, which can be achieved through careful supervision and day-to-day guidance. This is possible only when the number of postgraduate students per supervisor is four or less

Recommendation No. 3. Regarding the period of training it was felt that four years after full registration should be required for postgraduate training in all clinical disciplines.

Recommendation No. 4. Concerning the methods of training it was observed that the number of didactic lectures should be cut down as far as possible for the postgraduate training, as such lectures are of limited value.

It was therefore felt that within the framework of the courses, candidates should be given ample opportunities for learning through observation, participation in the seminars, and clinico-pathological conferences.

It was also recommended that the candidate be given graded responsibility for patients in the speciality during the period of training.

It was pointed out in conclusion that the methods of training should be utilised in such a way as to help the candidate to gain self-confidence, initiative, resourcefulness and competence in the speciality of his choice.

Recommendation No. 5. Effective postgraduate training can be carried out only when the minimum essential requirements of physical facilities, staff and equipment have been provided. Furthermore, there is a need to co-ordinate the development of pre-medical, para-

The training programme and the methods of assessment of postgraduates were discussed in all their aspects and one conclusion which emerged from the deliberations was that the training programme should be extended from three to four years after full registration. A candidate should be asked to write a thesis instead of a dissertation and the examination should consist of written, oral and practical tests in addition to continuous assessment of the candidates throughout the training period. The number of lectures should be cut down, lectures being not of much use in postgraduate training, and methods other than lectures should be introduced for building up the candidates' confidence, initiative, resourcefulness and competence in the speciality of their choice. All these were accepted as sound suggestions. It was also felt that, within the framework of the courses, the candidates should be given ample opportunities for learning through observation as well as through participation in the seminars and clinicopathological conferences in addition to giving them graded responsibility for patient care in the speciality during the period of training.

The necessity for a thesis or dissertation as a prerequisite for postgraduate examinations was reviewed and it was pointed out that research-oriented syllabus is an essential element in the training of postgraduates, for the aim of the postgraduate teaching should be to inculcate in the mind of a student a scientific attitude rather than to hammer out a technician or a draftsman. Therefore, in the preparation of a thesis, individual research should be given greater importance than any other thing, as research in postgraduate education is likely to play an important part in all fields of medical education, including teaching and general and specialist practice. Though postgraduate candidates will be mainly working in their respective specialities, a few of them might like to continue advanced research in the subject of their choice. There is no reason, therefore, why research students should not be encouraged and why research work should not constitute a significant part of postgraduate studies. In order to provide academic recognition, a student doing research could be given the opportunity to register for the Ph.D. Degree.

The organisation of postgraduate departments, with particular reference to the postgraduate institutes and the medical colleges where postgraduate courses are given, was reviewed with a view to finding a pattern. The role of the medical college hospital in postgraduate medical education in all its facets was considered and the importance of bringing the basic medical sciences closer to the clinical sciences in hospitals was emphasised. It was considered that effective postgraduate training can be carried out only when minimum essential facilities for work exist. Further, the need for co-ordination among pre-medical, para-medical and clinical departments was stressed. Thence in expanding a department for undertaking postgraduate training, attention should also be paid to the overall development of other related departments (pre- and para-clinical).

It was considered that for the sake of uniformity of standards of postgraduate examinations in the country, it was necessary to conduct national examinations.

The necessity to have continuing medical education for specialists, generalists, basic scientists and research workers was stressed and the role of the medical colleges and the professional and specialist organisations in this important field was emphasised.

The importance of postgraduate training for nurses in the upgrading of health care was pointed out and a pattern of postgraduate education in nursing was also suggested.

GENERAL PRINCIPLES OF POSTGRADUATE MEDICAL EDUCATION

Chairman's Report

THE Conference at its plenary session considered the general principles of postgraduate medical education.

The organisational pattern of postgraduate medical education was reviewed in the light of the developments that have taken place since the First and Second World Medical Education Conferences which had discussed two themes, namely, "Philosophy of the First Rate as the Objective of Undergraduate Medical Education" and "Medicine as a Life-long Study." It was agreed by the members of the Conference that *postgraduate medical education* comprehends (a) graduate medical education after full registration, (b) postgraduate education for a qualification, either for a diploma or a degree, and (c) continuing education for the specialist or the general practitioner. Emphasis was laid on the need for the clinical training for interns and house surgeons and the necessity to have residency type of training for the postgraduates in the clinical sciences. It was also felt that there was need for reorganisation of the hospital services and the creation of posts of interns, house surgeons and residents, and improvement of facilities for trainees in the form of library, laboratory, X-ray, conference rooms, hostels, etc. The present situation in India, compared with that prevailing in other countries, was reviewed for evolving a pattern of reorganisation at the national and regional levels in our country.

The method of selection of the postgraduate student, his qualifications, the training that is to be given to him and the facilities to be offered to him, all these aspects were emphasised. It was thought that the postgraduate students are to be trained as generalists, specialists, investigators or teachers, each according to his aptitude, because each of these professions has a specific role in the medical organisation. It was also considered that academic proficiency constitutes only one of the many criteria for postgraduate students, and, therefore, it was observed that the aptitude of the candidate, his powers of observation and expression should be taken into consideration at the time of admission. For objective assessment of the candidates during their housemanship and internship, the need for developing suitable yardsticks was emphasised.

The criteria for selection of a postgraduate teacher were reviewed and it was agreed that emphasis should be laid not merely on merit, but also on his capacity for research and his ability to teach. Hence, training of teachers, specialists and investigators was considered important. It was also agreed that since teaching of the speciality might constitute one of the important activities undertaken by the postgraduate students, all postgraduate students should be given suitable opportunities to learn the basic principles and methods of teaching. In addition they should be given adequate opportunities for teaching.

III

POSTGRADUATE MEDICAL EDUCATION IN BASIC MEDICAL SCIENCES

ORGANISATIONAL PATTERN OF POSTGRADUATE TRAINING PROGRAMME IN ANATOMY

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THE pattern of postgraduate training programme is to be considered on the basis of the area and content of the field of anatomy, the international standard of research and teaching in anatomy and its modern trends as against its present status in our country. A goal has to be set for the standard of its practice in the country and then formulate steps by which a department is organised as a sound base for training and research covering the entire field. The organisation of the postgraduate programme can then be based on the research activities and the courses offered by the department. Further, the degree the postgraduate is aiming at and the minimum time required to complete adequate training should be taken into consideration.

The rationale of the organisational pattern of postgraduate programme has been given more emphasis in this paper than the organisational pattern itself because the latter is apt to vary from place to place and, therefore, it can be tackled best by the individual organiser.

One of the main features of the science of anatomy has always been its unusually wide scope. The subject embraces the whole range of organic structure, i. e. the organisation of the elementary component of living matter that forms a complete cell, the organisation of tissues, organs and finally the integrated living organism. All these are included in the subject of anatomy.

Our present knowledge with regard to the structure which forms the basis for the mechanism of activities in a living organism is derived mostly from inferences based on the study of cadaver which has now been found inadequate for the study of the living body. Therefore, most problems are now being investigated directly from the study of the living human or animal subjects by new methods. All the new developments in biology on account of the rapid advances in pure sciences and technology, have also affected the developments in human anatomy, thus widening the scope of its application to all branches of the medical sciences. Application of technical methods, particularly experimental, to the study of anatomical problems is being used on a wide scale, which demands a high degree of technological knowledge.

The subject of anatomy is traditionally classified under such headings as Neuro-anatomy, Cardiovascular anatomy, Respiratory anatomy, Gastro-enterological anatomy, Reproductive biology, Urological anatomy, Endocrinological anatomy, etc. But the investigatory and training activities in the field are carried out at the following levels of observation:

1. *Gross and topographical anatomy*
2. *Histology*

The following units are suggested tn be established in an upgraded department of anatomy.

1. *Gross and topographical anatomy*

This unit has already an established tradition in India. A medically trained person witb an F.R.C.S. or M.S. Surgery or M.S. Anatomy qualification with Ph.D. and postdoctoral training and good research experience may take charge of all activities in this working unit. This unit is traditionally suited for integratinn with the clinical activities of tbe bospital. The personnel chosen for this unit could alsn do part-time work as clinical scientist. This gives mutual benefit to both anatomical and clinical research and teacbing.

2. *Micro-anatomy*

This unit bas a wide scope to undertake work in any speciality like Neuro-anatomy, Cardiovascular anatomy, Respiratory anatomy, Gastro-enterological anatomy, Reproductive biology, Urological anatomy, Endocrinological anatomy, etc. as and when expert personnel become available. To begin witb, it could be one working unit under a specialist in any one of the above fields.

3. *Neuro-anatomy*

Tbis is the only systematic discipline in the micro-anatomy group which has application to all other fields and requires special equipment and knowledge of technology. An expert in neuro-anatomy with knowledge of neuro-anatomical, neurochemical and neuropbysiological technique may head this unit.

4. *Experimental embryology*

Experimental embryology (morphogenetics) is a special branch of anatomy. Tbe problem of organisation of the unfertilised germ cell and of the developing ovum is now being pursued with histochemical and biocbemical techniques. Tbis field is marked by improvements in technical methods of experimental work on the mammalian embryo *in-utero* and on the chick embryo in the egg. These techniques are beiog osed for the study of developmental mechanics of moulding of organs, study of cellular differentiation and migration and are applicable to problems of growth, repair, and regeneration. Tissue culture technique is used for the study of morphogenesis and differentiation. An expert in this field will head this unit.

5. *Histochemistry and cytology*

Histochemistry reveals a new threshold of knowledge. As Le Gros Clerk has expressed it, a wealth of knowledge has accumulated in the past from the architecture of tissues and cells which has enabled us to discern the cbemical and enzymatic pattern in tbe cellular architecture. From this will emerge the understanding of the functional and metabolic state of the tissue. Thus, from histology and cytology of the part, tbe new field of histo- and cyto-chemistry is emerging which will develop into histo- and cyto-physiology.

The recent developments in pure sciences have led to new optical methods which are the most outstanding features in the recent progress of histological research. The two new fields developed in the investigation of the structure of tissues are:

(a) *Ultro structure and electron microscopy*
(b) *Histochemistry*

More than this, anatomy is also a historical subject in so far as it is concerned with the genesis and growth of tissues and organs from germ cell. It is also concerned with the evolutionary origin and development by the varied manifestations of structural organisation during the distant ages of geological past. The following fields come in this category:

1. *Problems of growth ond development*

   Human embryology
   Development of normal child up to adult stage and geriatries
   Maintenance, repair
   Teretology
   Regeneration
   Transplants, grafts, etc.

2. *Morphology in organic evolution*

   (a) Comparative or vertebrate embryology
   (b) Comparative anatomy
   (c) Genetics
   (d) Physical anthropology
   (e) Palaeontology—fossil study of human and primates

On account of the wide scope of the area and content of anatomy and the technological advances in the field, the organisation of the department of anatomy requires careful thought and planning. The modern anatomy has branched into a number of specialised fields, each having a vital role to play in all the fields of modern medicine. Thus the new demands on the department of anatomy from all clinical fields are increasing daily. Time has come when no one individual can claim to be the master of all the fields comprising modern anatomy. In order to carry out both training and investigation in all its *branches effectively, the* department of anatomy requires to be divided into a number of working units to be run by specialists. Since the branches of anatomy are many, a feasible number and type of working units initially to be established in the department of anatomy depends on she following considerations:

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6. *Ultra structure—Electron microscope unit*

In the days when light microscope was first used for biological studies, a new life with a new vista opened out before the investigators and as a result a large variety of facts became available which led to the modification of the existing concepts. Likewise, the use of electron microscope has now opened a new world. This new field together with the use of new instruments and new technique will doubtless extend our vision of the living unit towards the direction of molecular anatomy. Vast amount of new observations have been made in advanced countries with this new instrument during the past 15 years. In India, on the other hand, not a single anatomy department possesses yet the facility for using this instrument. Consequently, our keen young men and women are losing a great chance of participating in this challenging venture of anatomical sciences and, therefore, contributing original work in this fertile field in large numbers. We must, therefore, consider the urgency of establishing this field in anatomy.

7. *Human genetics*

During recent years there has been a rapid advance in human genetics and this is due to the work on mammals and human beings which has now been made possible. There has been greater realisation of the need for development of this field in medical institutions and also for the need of including it in the medical curriculum. W.H.O., Ford Foundation and other organisations are keen to help the development of this field.

It is now being realised that man being a product of heredity and environment, both factors not only operate throughout the normal growth and development of an individual but also affect his reactions during age and sickness. During the past half a century, the environmental pathogenic factors were investigated for knowledge of etiology and method of controlling of disease As a result, in recent years the genetic aspect of diseases has assumed importance.

There is a great scope in the application of the discipline for correlation with embryology and anatomy. Because of its importance in connection with the development and malformation of the individual and the concept of variation within the species which have thrown light on certain differences in susceptibility to disease and for certain types of hyperreaction, it is taken for granted that this new knowledge will also be extended to clinical fields.

8. *Physical anthropology, human and primate palaeontology, comparative anatomy and evolution*

These may form a composite unit dealing with basic biological and historical aspects of anatomy. This unit can function under a specialist in any one of the composite fields.

Having explored the area and content of modern anatomy, and the rationale of organisation of a department of anatomy to meet the needs of modern medicine, the principles guiding the planning of postgraduate programme in anatomy are considered below:

1. Advanced knowledge of pure sciences such as physics, chemistry, mathematics, psychology, sociology, etc., which is a prerequisite for postgraduate training in anatomy and which has not been covered in the university training, may be made up in the curriculum of the postgraduate.

2. The necessity for the postgraduates to have basic knowledge in different branches of anatomical sciences as also in allied sciences and their recent trend, is now a recognised fact. As postgraduate training for M.S. Anatomy is broad-based, it is necessary to have a biological, biophysical, biochemical and physiological background in order to prepare them for entry into new frontiers of anatomy. Modern development of viewing structure even at a molecular level should be kept in view.

3. The historical aspect of how the human body came to assume its present status, man's place among mammals and vertebrates and principles of organic evolution and origin of man are also to be included in the curriculum.

4. During the period of training a student should view the subject as an investigator and a learner and the whole group of academic staff and postgraduates of the department should be tuned to this approach. Since the traditional method of teaching is nothing but transference of the existing knowledge from one category of people to another, it is necessary to lay emphasis on the habit of investigation and critical thinking in addition to formal lectures.

5. Considering the low standard of technology in India at present, methods of investigation should be given high priority. These methods include instrumentation of all types, histological, physiological, biophysical, biochemical, histochemical techniques, etc.

6. Knowledge of the history of medicine, anatomy, embryology and neurology enables the student of the postgraduate class to appreciate the increasing urge of man to know more about himself and also to understand the philosophy behind the practice of scientific anatomy. Therefore, we must also consider this in framing the syllabus.

7. The postgraduates should be encouraged to be familiar with the activities of international organisations in anatomical and other biological fields. They should be taught to keep abreast of the more important developments in anatomical and allied sciences and they should keep in mind their own not-too-high scientific standards in comparison with the international standards. In fine, they should be interested in the problems of medical education in their country and abroad.

8. It is advantageous for a postgraduate to have working knowledge of more than one foreign language which is most useful for keeping in touch with the current scientific developments of other countries.

9. *Experience in undergraduate teaching.* The postgraduates may be given assignment for teaching the undergraduates not only to gain experience in "teaching" and learning the subject through "teaching" but also to impart to the undergraduates the idea of learning through observation, the necessity for contributing new knowledge and the development of the mind of enquiry. Immense mutual benefit can be derived by both undergraduates and postgraduates in this way. The attention of the postgraduates should be directed to the fast-expanding and developing character of the science of anatomy and its communciation within the limited time available to the undergraduates. This will naturally stimulate the postgraduates to discover ways and means of facing the situation.

10. Concurrent clinical training is often recommended for postgraduates in medical institutions. The principles underlying this training are to enable the anatomy teacher to be

aware of what preparation is required for the undergraduates for initiation into the clinical training and, secondly, to understand the anatomical basis in the production, diagnosis and treatment of diseases. Every clinical department conducts worthwhile courses, and these may be attended with advantage by the postgraduates in anatomy. It requires a great deal of thought to choose the right clinical sessions which will be found most useful to postgraduates in anatomy, particularly in view of the limited time at their disposal. In this connection, a warning is appropriate. M.B.B.S. graduates have had this clinical experience already. A poor repetition of the same is, therefore, a waste of their valuable time. Considerable discretion needs to be exercised in utilising clinical facilities for postgraduate training in anatomy.

It is generally accepted that a period of about 5 years of intense activity in a scientific field makes one competent to begin to function as a specialist. The five-year period may be completed in two stages. The first stage builds up a broad base in the fundamentals of all the branches of anatomy, including the allied fields of physiology, biochemistry, biophysics and methodology of research. After the completion of this course, the Master's degree may be awarded. This qualifies the candidate to proceed to the second stage which enables him to study intensively in a limited field of his choice. It is expected of the candidate to do independent original work under supervision. After the satisfactory completion of the work, the degree of Doctor of Philosophy may be awarded.

A curriculum for postgraduate training for the award of M.S. degree in anatomy is given below:

I. *Basic sciences*

Besides advanced physics, chemistry and biology, the following subjects may be added:

1. Biophysics
2. Biostatistics
3. Mathematics
4. Psychology and sociology

The courses in these subjects in the university departments may be attended by the postgraduates.

II. *Allied medical sciences*

1. Physiology
2. Biochemistry

A good undergraduate standard in these subjects is essential

III. *Anatomical sciences*

Fields to be covered in advanced courses in anatomy:

1. Gross and topographical anatomy
2. Neuro-anatomy
3. Micro-anatomy, cytology, including ultra structure

4. Developmental anatomy
   (a) Human embryology (pre-natal development)
   (b) Comparative embryology
   (c) Development of normal child up to the adult stage
   (d) *Maintenance and repair*
   (e) *Modern trends in geriatrics*
5. Historical aspect of man
   (a) Comparative anatomy and phylogeny
   (b) *Physical anthropology* and *palaeontology*
   (c) Genetics
   (d) Principles of organic evolution

IV. *General*

(a) Language—one European language besides English, e.g. German or French or Russian
(b) History of medicine, anatomy, neurology and embryology
(c) Medical education with special reference to the place of anatomical sciences in the training of medical scientists who choose a career in all or any two or one of the three of the following services:
   (i) Clinical practice
   (ii) Teaching
   (iii) Research
(d) Current activities of the international and national anatomical organisations

V. *Technology*

1. Microscopy
   (a) Phase contrast
   (b) Fluorescence
   (c) Polarising
   (d) Electron microscope
   (e) Reflecting microscope
2. Chromatography
3. Spectroscopy and spectrophotometry, spectrofluorometry
4. Radiography; auto-radiography; X-ray diffraction technique and radio isotopes
5. Tissue culture technique
6. Histological, histochemical techniques
7. Cadaver injection—embalming
8. Museum technique
9. Operation techniques
   (a) Clinical
   (b) Experimental

10. Electro-anatomical technique
11. Photomicrography

Some familiarity with all modern tools and equipment used for research is essential.

Practice in the methodology of research

(a) Designing experiments for research
(b) Instrumentation and techniques
(c) Practice in going through large volume of literature
(d) The art of writing a thesis or an article for publication

AIMS AND CONTENTS OF POSTGRADUATE CURRICULUM IN ANATOMY

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THE emphasis in any medical institution now is more and more on postgraduate studies where only the minimum facilities for undergraduate studies are available. However, postgraduate medical education will not be what it ought to be, and will not get the necessary facilities and the impetus needed unless some definite conditions are laid down in regard to these courses. Postgraduate facilities in clinical subjects cannot possibly be available to the extent needed if simultaneously the preclinical departments are not correlated with the particular postgraduate subjects of study that are to be undertaken. From this point of view, it is an excellent programme to start an Institute of Basic Medical Sciences as a preliminary step to upgrade our postgraduate teaching and research in clinical and non-clinical subjects. It cannot be denied that conditions that would be required for such an object will not be available in each of the medical institutions in our country. For this purpose, therefore, the only alternative to the present conditions in our country is that, wherever there are two or more medical colleges or institutions, we should avail of the existing facilities for postgraduate teaching by adopting inter-college co-operative teaching. Further, our universities have upgraded their own departments to the extent that government institutions were not able to do. In view of such facilities being available in many Indian universities, these resources should also be pooled and utilised in our programme of postgraduate teaching.

In anatomy, for instance, in recent years, many side specialities have developed—embryology, histology, histo-chemistry, neuro-anatomy, physical anthropology, surgical anatomy, odontology, etc. Each of these specialities requires separate well-organised laboratories manned by persons trained in these different branches as separate specialities. For this purpose, equipment may be pooled and utilised with much advantage both alike by university departments and government institutions. In Madras, for example, the only place where advanced biochemical work can be done is in the university department. The facility to work with an electron microscope exists only in the botany department of the University.

Unless all these facilities are utilised, our aim to upgrade the postgraduate teaching and research in our country will progress very slowly indeed.

On the clinical side, for instance, the rapidly developing subject of neuro-surgery will be very much behind international standards unless the students of postgraduate class in this highly specialised department get the advantage of a team of teachers associated with the teaching of the specialities like anatomy, neuro-chemistry, neuro-physiology, neuro-pathology, neuro-bacteriology, etc.

The objective which all the postgraduate departments, whether medical, surgical or other

specialists, should follow is to bring their postgraduate student in line with the current trends in the medical sciences which are of importance to future medical developments. To this end we should organise combined clinical and basic medical science courses. All postgraduates during this period, of at least 6 months in the basic medical training, should have a clinical attachment in the special subject of their choice, such as general surgery or medicine, cardiology, cardio-vascular surgery, endocrinology, dermatology, hematology, paediatrics, psychiatry, orthopaedics, obstetrics and gynaecology.

The number accepted for this educational programme should not be more than two or three under each speciality for an institution. All should attend the basic medical sciences course. Moreover, a supervisor should guide their reading and laboratory work and in appropriate cases a student should be allowed to take part in current research programmes.

The concept that anatomy is the study of the dead animal has tended to limit the field of research. It is also wrong to think that anatomy is restricted only to the study of human beings. The fields of heredity, genetics, morphology and physical anthropology offer unrestricted possibilities to the anatomist in the study of the living man.

If this is accepted, we should drastically change our mode of teaching and reorganise our anatomical laboratories to the needs of our new medical curriculum.

Anatomical teaching in future, I feel, should be linked up with the team work in other subjects such as medicine, surgery, obstetrics, neurology, opthalmology, etc.

The actual dissection part of the curriculum for postgraduates can be completed in the earlier part of their study, eliminating those useless details with which it is at present saddled. The supervision of this part of dissection can safely be entrusted to junior surgeons and junior staff of the anatomy department. However, the study should be in the hands of the senior staff of the anatomy departments.

There should at least be one such postgraduate medical centre of training in each State where all the specialities will gradually develop. The training given in postgraduate centres should be of a comprehensive nature including not only the basic medical seicnces but also some of the fundamental biological sciences.

Medical literature has expanded in recent years very rapidly and, as a result, not one single faculty can cope with the entire load of the curriculum.. We must decide what we should ask the student to study.

The selection of syllabus for teaching each speciality must be done by the faculty as a whole rather than by one department singly, which becomes more and more specialised as our present-day knowledge increases.

By inter-departmental programme of teaching, much duplication can be avoided. Also, the teaching of anatomy cannot be handled by one department alone. The subject of anatomy branches out in several directions and it concerns several departments. Therefore, to teach effectively, we must give up our present conventional departmental system.

I feel I must stress here the fact that medical graduates are not being given sufficient attractions in our country to take up postgraduate studies is non-clinical subjects. The reasons for this are well known to everyone and I shall not dwell on this subject here. Unless the paucity of candidates for postgraduate training in non-clinical subjects is overcome, our

departments in non-clinical subjects will continue to be staffed by medical graduates who are not interested in learning or teaching the subject but are forced to occupy a berth in these departments by force of circumstances.

To remedy this defect, Madras has introduced a system which I should like you to study and comment on. In the Madras University the course of study for the M.Sc. degree in non-clinical subjects is open only to science graduates but is conducted in a medical college. The syllabus and content of the curriculum for this course are appended to this paper (Appendix C) which incidentally will give an idea of the requirements for an anatomy department, training postgraduates in anatomy and its specialities.

A study of this syllabus drawn by a committee with which Professor L. W. Chacko of All-India Institute of Medical Sciences was also associated will indicate that these science graduates will form a nucleus in the future non-clinical departments around which can be built an efficient laboratory, an effective research project and departmental programmes and schedules. These non-clinical scientists, it is hoped, will continue to serve the department without clamouring to go in for any other speciality. Such devoted workers in individual subjects are necessary at present for the future development of the postgraduate medical education in our country.

If the best of our professors could not compare favourably with the approved specialists in other countries, it is, in my opinion, due to insufficient and inefficient support and help from suitably qualified and willing assistants. Under these circumstances the introduction of non-medical scientists in our non-clinical departments will remedy the long-felt need. These men, in years to come, will prove to be experts in their specialities and may publish text books and contribute valuable research work. These non-medical scientists should not be considered a class by themselves. They are scientists devoted to their subjects who have chosen a speciality as their life-long career.

Medical specialists of the future should have to learn, from physicists, from chemists and from other scientists, various technological details for their own benefit and guidance.

However, the Madras University has stipulated that, to give a medical bias to teaching schedules, the heads of non-clinical departments should continue to be medical men with postgraduate qualification in the speciality in addition to the required teaching and research experience. The non-medical scientists could aspire, however, to become additional or associate professors in these departments.

There is another aspect of postgraduate training in anatomy which we in Madras have adopted since 1957. The first postgraduate degree in anatomy is a course of study for two years without the necessity of writing a thesis. The candidate, in addition to a general study of gross anatomy, chooses a special subject from any one of the five subjects enumerated below:

1. Histology
2. Embryology
3. Neuro-anatomy
4. Surgical Anatomy
5. Odontology

Only those candidates who have taken this M.Sc. degree are allowed to register for the Ph.D. degree.

It is our aim that the postgraduates in anatomy should not only be teachers but also research workers in fundamental sciences. They must also be trained in the technology of research and must be well acquainted with the use of modern appliances, laboratory techniques and research methods. We should therefore plan to train our postgraduates to treat anatomy not only as a factual science but also as an experimental science. We should introduce the experimental approach to anatomical problems, in particular to problems relating to functional significance of the various structural systems of the body.

The methods adopted for prosecution of these enquiries must necessarily be of comparative anatomical and embrylogical approach. Experimental techniques in the study of biological problems are being rapidly developed by physiologists who are primarily interested in the chemistry and physics of the living process. The conception that any experimental work on the living body is essentially the province of physiology rather than of anatomy should be rejected and, to do so, a multipurpose laboratory must be developed. In our country, anatomists should turn their attention to more productive fields of research, rather than to mere morphology, involving extensive employment of experimental methods.

I have given in this short paper some food for thought and discussion. As instructed to me by Dr. Coelho, Chairman of our Conference, I have confined my paper to the principles of postgraduate medical education and the application of these principles in various disciplines in India.

Another wise suggestion he gave me in preparing this paper was that I should limit my views to "conditions in our country," that is, to "what we do now, our present resources, what we want for the immediate and the near future and how we can go about and get them."

I hope and trust you will remember his valuable advice and keep our discussions within the scope he has prescribed for us. I shall conclude by quoting his final advice: "We are concerned with marching forward through our own energy, utilising all our resources. Our watchword should be endeavour and not just discontent."

APPENDIX C

DEGREE OF MASTER OF SCIENCE
(in the Faculty of Medicine)

1. Candidates who have qualified for a Degree in Science of this University with the specified groups or options, or an examination of some other University accepted by the Syndicate as equivalent thereto shall be permitted to appear and qualify for the M.Sc. Degree Examination in the non-clinical subjects under the Faculty of Medicine of this University after a course of study of three academic years in a constituent or an affiliated college of this University, or in an institution approved for the purpose.

2. The course of study for the Degree shall be in any one of the following branches according to a syllabus to be prescribed from time to time:

Branch I	—	Anatomy
Branch II	—	Physiology
Branch III	—	Biochemistry
Branch IV	—	Pharmacology
Branch V	—	Microbiology
Branch VI	—	Biophysics

3. *Eligibility for admission*

A candidate for admission to Branch I—Anatomy—should have passed the B.Sc. Degree Examination with any two of the following subjects of Mathematics, Physics, Chemistry, Botany or Zoology, of which one should have been taken in the main standard, and the other in the ancillary standard.

A candidate for admission to Branch II—Physiology—should have passed the B.Sc. Degree Examination with any three of the subjects of Physics, Chemistry, Botany and Zoology of which one shall be of the main standard, and the other two subjects of an ancillary standard.

Provided that a candidate who is deficient in one ancillary subject may be admitted and required to pass an examination of the first year integrated medical standard in that subject at the preceding December examination before taking the preliminary examination, failing which he shall be required to take that examination along with the Preliminary Examination.

A candidate for admission to Branch III—Biochemistry—should have passed the B.Sc. Degree Examination with Chemistry as the main subject.

A candidate for admission to Branch IV—Pharmacology—should have passed the B.Sc. Degree Examination with Chemistry as the main subject or Zoology as the main subject with Chemistry or Botany as ancillary, or should have passed the B.Sc. Examination in Pharmacy or the Bachelor of Pharmacy Examination of the University.

A candidate for admission to Branch V—Microbiology—should have passed the B.Sc. Degree Examination with Physics, Chemistry, Botany or Zoology as the main subject or the B.Sc. Degree in Home Science.

A candidate for admission to Branch VI—Biophysics—should have passed the B.Sc. Degree Examination with Physics as the main subject, or Chemistry as the main subject with Physics as ancillary.

4. *Courses of study*

The course of study shall extend over a period of three academic years, and shall consist of two parts, the Preliminary and the Final. The first year of study will be devoted to the preliminary part which shall consist of Anatomy, Physiology and Biochemistry, and shall be common for all branches. The remaining two years will be devoted to the study of the main branch.

5. *Scheme of examination*

The examinations for the Degree shall be written, practical and oral. There shall be two examinations, viz. Preliminary and Final. The Preliminary Examination shall be taken at the end of the first year and the Final Examination shall be taken at the end of the third year.

No candidate shall be permitted to proceed to the second year of study unless he has passed the Preliminary Examination, and in the ancillary subject, if any, in which he is deficient in the case of Branch II—Physiology.

6. *The scheme of examination shall be as follows*

Preliminary

(common to all branches at the end of the first year)

			Hours	Marks
Paper I				
Anatomy		...	3	100
Paper II				
(a) Physiology	... 60			
(b) Biochemistry	... 40	...	3	100
Viva voce				
Anatomy		...	...	50
Physiology	... 30			
Biochemistry	... 20	...	...	50
		Total		300

Final

(at the end of the third year)

Branch I—Anatomy			
Paper I	...	3	100
Paper II	...	3	100
Paper III	...	3	100
Viva voce	...	...	50
Class records	...	...	50
Practical I	...	3	100
Practical II	...	3	100
	Total ...		600

The scope of each paper will be as indicated in the syllabus. There shall be two examinations in a year, in the months of March-April and September-October.

7. *Marks qualifying for a pass*

(a) A candidate shall be declared to have passed the Preliminary Examination if he obtains not less than 50 per cent of the marks in (i) Anatomy (Written and Oral) and (ii) Physiology including Biochemistry (Written and Oral).

A candidate who fails in one subject, viz. Anatomy or Physiology including Biochemistry, may be permitted to take the examination in that subject only and qualify for the Preliminary after putting in additional attendance till the next examination.

Candidates passing the Preliminary Examination shall be permitted to join the second-year course immediately after passing in September-October.

No candidate shall be permitted to sit for the Preliminary Examination on more than four occasions.

There will be no classification for the Preliminary Examination. A candidate who secures 75 per cent of the marks will be deemed to have passed the Preliminary Examination with distinction.

(b) A candidate shall be declared to have passed the Final Examination if he obtains not less than 50 per cent of the marks in the written papers and oral taken together, and 50 per cent of the marks in the practical examination and class records.

All other candidates shall be deemed to have failed

A candidate who fails in the Final Examination shall put in additional attendance till the, next examination and take the whole examination.

8. *Classification of successful candidates*

A candidate who obtains not less than 60 per cent of the aggregate marks in the Final Examination shall be declared to have passed the Examination in the First Class. A candidate who obtains not less than 50 per cent of the aggregate marks but below 60 per cent of the aggregate marks shall be declared to have passed the examination in the Second Class.

A candidate who obtains not less than 75 per cent of the aggregate marks shall be deemed to have passed the Examination in the First Class with Distinction.

9. *Symbolic representation of marks*

Symbolic representation shall be adopted in declaring the results and a statement of marks shall not be furnished.

Symbol A plus will denote 65 per cent and above of the marks but below 75 per cent of the marks.

Symbol A will denote 60 per cent and above of the marks, but below 65 per cent of the marks.

Symbol B plus will denote 55 per cent and above of the marks but below 55 per cent of the marks.

Symbol B will denote 50 per cent and above of the marks, but below 55 per cent of the marks.

Symbol D plus will denote Special Distinction signifying 85 per cent and above of the marks, but below 100 per cent.

Symbol D will denote distinction signifying 75 per cent and above of the marks, but below 85 per cent of the marks.

Symbol F will denote failure.

Syllabuses

(Preliminary)

(Common to all branches at the end the first year)

Paper I—Anatomy (First Year)

Theory

General Anatomy

1. Topographic Anatomy.
2. Radiological Anatomy.
3. Applied Anatomy.
4. Forensic Anatomy.

Practical

Gross Anatomy:

Complete dissection of human cadaver

Micro-anatomy:

Human tissues and organs practicals

Neuro-anatomy: Theory.

Practical:

Dissection of brain and spinal cord and study of microscopic section at different levels of the brain and the spinal cord.

Developmental Anatomy:

Orgogenesis and histogenesis in human up to birth (Physiology and Biochemistry may also be completed during this period).

Final

(examination at the end of the third year)

Branch I—Anatomy

Syllabus

2nd and 3rd year

Advanced Anatomy

1. General Anatomy: morphology
2. Micro-anatomy: general cytology, cytogenetics, electron microscopic anatomy
3. Neuro-anatomy
4. Developmental Anatomy: with practical work:
   Comparative embryology, experimental embryology, development of normal child to adult, maintenance and repair, modern trends in geriatrics

5. (a) Principles of Organic Evolution
   (b) Comparative Anatomy
   (c) Elements of Palaeontology
   (d) Elements of Physical Anthropology
   (e) Elements of Genetics
6. Technology:
   (1) Microscopy:
      (a) Phase contrast
      (b) Fluorescence
      (c) Ultra-violet
      (d) Polarising
      (e) Electron Microscope
      (f) Reflecting Microscope
   (2) Spectroscopy, Spectrophotometry, Flame Photometry, Calorimeter, PH Meter, Electrophoresis and Paper and Column Chromotography
   (3) Radiography, Auto-radiography, X-ray diffraction technique
   (4) Isotopes
   (5) Tissue culture technique
   (6) Histological and Histo-chemical techniques
   (7) Cadaver injection—Embalming
   (8) Museum technique
   (9) Operation techniques:
      (a) Clinical
      (b) Experimental—common experimental surgical procedures
   (10) Electro-anatomical technique
   (11) Anaesthetics for laboratory animals
   (12) Kymographic technique in acute experiments
   (13) Perfusion technique
   (14) Method of drug administration
   (15) Log dose response curve
   (16) Experimental production of pathological state
   (17) Breeding and maintenance of experimental animals
   (18) Biostatistics

Research Project:

Methodology of research, technology of research, designing of project for investigation, writing of thesis

Written Examination

Paper 1: Human anatomy including neuro-anatomy, comparative anatomy and elements of embryology

Paper II : Micro-anatomy, cytogenetics, surgical anatomy and elements of physical anthropology

Paper III : Modern technology, including microscopy, isotopes tissue culture, histo-chemical techniques, animal operation techniques in the experimental animals, experimental embryology and biostatistics

Practical

Practical I :	Dissection—Cadaver and animal	...	1 day
Practical II :	Instruments, specimens, microscopic slides and practical histological work	...	1 day

NOTE ON STRUCTURE AND FUNCTION OF THE POST-GRADUATE DEPARTMENT OF ANATOMY

DR. HIREN CHATTERJEE
University of Calcutta

I. Anatomy in the Postgraduate Stage

WITH the change-over from the undergraduate stage to the postgraduate one, the pursuit of the science of anatomy undergoes almost a radical change. While in the undergraduate stage, anatomy is taught and studied with the object of turning out general practitioners capable of meeting the demand of producing efficient personnel for public health service, the study of anatomy naturally remains confined to human anatomy with an applied bias necessary for the study of clinical subjects. In the postgraduate stage, however, the horizon of anatomy widens out ; its outlook undergoes a radical change; its scope and activities present an expanding orbit and thus the study of anatomy emerges with full glory as a distinct and independent scientific discipline.

In the postgraduate stage the subject of anatomy no looger remains coofined or restricted to systematic human anatomy but actually includes in its domain a wider range consisting of comparative anatomy, morphology and evolution, physical anthropology, neuro-aoatomy, histology, histochemistry, tissue culture. developmental anatomy, genetics, living anatomy, applied anatomy, systematic anatomy and so on. Be it noted that each one of these members of the anatomical family is capable of presenting itself as a full-fledged independent scientific discipline.

Thus, from a very modest beginning, very much resembling a tiny sapling, a simple unimposing plant, the subject of anatomy today has assumed the dimensions of a gigantic tree with innumerable branches and rich foliage, thus presentiog the character of a complex arboreal unit full of glamour and pregnant with immense potentialities.

Consequently, a postgraduate department of anatomy is capable of including a host of separate branches noted above. But, for practical purpose, it may not be possible to include all of these at the very inception of the department. A beginning can be made with just a few sections and then we can expand gradually when proper type of teaching and research personnel as well as laboratories fitted with adequate equipments and instruments are available.

The scope and limits of a postgraduate department of anatomy being so wide, it is closely related to two other departments, namely, zoology and physiology. In guiding and conducting researches in the studies of comparative anatomy of certain organs—thyroid, gall-bladder, etc.—I personally came across quite a number of problematic functional hurdles that were difficult to solve and needed a concerted endeavour and joint efforts of both the anatomist and the physiologist. If "function determines structure" and "structure reflects the functional role," a team-work sponsored by both anatomists and physiologists would appear not only

Paper II : Micro-anatomy, cytogenetics, surgical anatomy and elements of physical anthropology

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desirable but a *sine qua non* in the field of biological research. For a very similar academic reason, the anatomist and the zoologist would appear to be inseparable twins exerting reciprocal influence on, and assistance to, each other to further the cause of both the sciences.

II. Interrelation of Anatomy, Physiology and Zoology

It appears, therefore, highly desirable from the academic point of view as well as from the point of view of usefulness and perfection of research, that the postgraduate departments of anatomy and of physiology should be so tuned as to ensure the desirable degree of integration—each one of the departments being both complementary and supplementary to the other. I have personally felt the extreme necessity of such a measure.

The interrelation between these departments being so very intimate, close and desirable, frequent contacts and discussions, interchange of ideas and the solution of problems arising out of research work need to be discussed freely and frequently. Discussions may throw new light, give new ideas, kindle new inspiration to research workers and provide them with the much desired academic impetus in their research venture.

III. Accommodation for Postgraduate Department of Anatomy

There cannot be any hard and fast "musts" with regard to accommodation in the department, as this would depend on many varied factors. The actual number of active units or sections in the department, the number of postgraduate students to be catered to, the number of research scholars and fellows, the number of postgraduate teachers in the department are all factors to be considered. Nevertheless a list (List I) is appended at the end of this note laying down an average accommodation as regards floor-space. It should be noted, however, that the provision with regard to accommodation should admit quite a degree of elasticity and as such can ill-afford to be absolutely rigid.

Further, it should be noted that up-to-date gorgeous buildings do not necessarily ensure good output of research work. Sir Ronald Ross, Sir Leonard Rogers, Sir Upendranath Brahmachari carried on their epoch-making researches in the most modest and none-too-imposing accommodation. In Paris I was shown by the illustrious Prof. Rouviere a dark, dingy room at the Faculte de Medecine where three old wooden chairs, an almost decrepit wooden shelf and a miserable wooden table, its top covered with an old piece of zinc sheet bearing stains of dyes, formed the entire furniture. Prof. Rouviere solemnly whispered into my ears, "We are in a temple. It is here that the great Sappey and Poirier carried on their outstanding researches. This is the table that they used."

IV. Departmental Staff—Teaching and Non-teaching

This again would depend on the type of activity the department has to carry on as also on the number of postgraduate students and research workers the department has to cater for. A list (List II) appended at the end gives a modest idea about the departmental staff—both teaching and non-teaching.

It is evident that the functions of the department would be mainly two— (i) postgraduate teaching in the different branches of anatomy, and (ii) research work by the

teaching staff, research scholars and fellows. A third function limited to a few experienced teachers is "research guidance."

Consequently, it is desirable, both logically and academically, that teachers in the department would be expected to have specialised in some particular branch of anatomy so that both teaching and research guidance in that particular subject could be entrusted to them with advantage.

When departmental duties consist of two different and distinct types—teaching and research—a combination of related talents would also be reflected in the recruitment of the staff. All research workers are not competent to teach. Some are born teachers of brilliance with mastery of language and expression, people who can inspire postgraduate students and kindle in them a thirst for more knowledge and rouse academic inquisitiveness. On the other hand, there are methodical research workers, diligent and painstaking, but who have no aptitude for teaching. In a postgraduate department, both the types have their rightful place and it is the judicious combination of both the types of talents that would go a long way in ensuring success to teaching and research.

The head of the department should be an experienced teacher with high academic distinctions. He should possess experience in research work. He should have papers and publications to his credit and should be capable of undertaking "research-guidance." He should be a person with a personality, and affection and sympathy for his staff. Above all he must be a teacher with ideas and vision so as to inspire his students, colleagues and workers. He must find out problems and inspire his subordinates in their execution. He ought to be endowed with the ability of building, equipping and developing his department. In certain cases it is not so much the work as the ideas that breed scientific problems for research and the head of the department would therefore be expected to be a man of scientific vision. It was only possible for a Pasteur to enthuse and inspire a Calmette or a Guerin.

V. Technicians in a Postgraduate Department

It is unfortunate that in a postgraduate department the role of technicians is not properly realised and assessed in many quarters. It must not be forgotten that, in the West, the research worker depends in no small extent on the abilities and efficiency of technicians. I cannot but refer to the relevant portion of a report submitted by Dr. Ivan L. Bennet, M.D., Professor of Medicine, Johns Hopkins University and Hospital in 1957, to the then Central Minister of Health, Raj Kumari Amrit Kaur. He said: "Perhaps the most obvious and easily remediable inefficiency in the utilisation of professional medical personnel in India is the lack of laboratory technicians comparable to those in western countries: There is a class of so-called 'technicians', poorly paid, relatively uneducated and really laboratory helpers." In order to improve the standard of research work in our country, it would not be sufficient to recruit research workers alone and remain totally indifferent to this very useful and essential personnel. Training of technicians is as much a desirable venture as the search for researchers—one is the counterpart of the other.

VI. Library Service in the Domain of Postgraduate Studies and Research

This is another vital ancillary service and its absence proves to be a rock against which the

ship of postgraduate studies and research may founder. In his report referred to above, Prof. Bennet says, "No medical college in India possesses adequate library." This is certainly no compliment to our authorities who profess to look after and encourage research. Setting up of properly furnished reference libraries with adequate "library-service" facilities is a *sine qua non* for postgraduate studies and research. Zonal libraries can be set up in our country and the UNESCO can be approached for securing its active assistance and help in this matter.

VII. Departmental Equipments

A list (List III) of these has been appended at the end of this note. The list is neither complete nor inelastic and consequently admits of modifications and additions according to necessity.

VIII. Conclusions

This note lays down an outline of different facets of postgraduate studies and research in anatomy. A full discussion with regard to the different aspects of the problem is sure to bring out further clarification of ideas. Another important point that needs immediate consideration is the question of having an Anatomy Act without any further delay. Medical colleges are coming into existence like mushrooms and yet the authorities continue to appear to be indifferent with regard to ways and means of procuring dead bodies for scientific purposes. Some of the States have enacted legislations to this effect but these are seldom being executed. It is time for the Central Government to come forward and to take the initiative in this regard.

I convey my thanks to Prof. Wahi and his colleagues in the Association for having included me in the sub-committee on anatomy and for inviting me to write the present note. I am also grateful to my friend, Professor Chacko, Convenor of the Sub-committee on Anatomy, whose "orders" I could ill afford to ignore and have, therefore, carried out to the best of my limited abilities.

LIST I

Department of Anatomy (Floor Space)

1	Professor's room	—	25' x 15'	375 sq. ft.
2	Professor's working room	—	25' x 15'	375 ,, ,,
3	Readers' rooms (2)	—	15' x 15' x 2	450 ,, ,,
4	Readers' working rooms (2)	—	15' x 15' x 2	450 ,, ,,
5	Lecturers' rooms (3)	—	15' x 15' x 3	675 ,, ,,
6	Lectures' working room	—	30' x 25'	750 ,, ,,
7	Research Scholar's room	—	15' x 15'	225 ,, ,,
8	Research Scholar's working room	—	15' x 15'	225 ,, ,,
9	D. Phil. students' room	—	15' x 20'	300 ,, ,,
10	Dissection hall	—	50' x 30'	1,500 ,, ,,
11	Museum	—	75' x 50'	3,750 ,, ,,
12	Preparation room	—	15' x 15'	225 ,, ,,

13 Stores	—	25' x 25'	625 sq. ft.
14 Radiology and Photography Section (X-ray room, developing room, photography room)	—	30' x 45'	1,350 ,, ,,
15 Histology laboratory	—	30' x 25'	750 ,, ,,
16 Tissue culture room	—	15' x 15'	225 ,, ,,
17 Physical anthropology laboratory	—	25' x 25'	625 ,, ,,
18 Refrigeration room	—	15' x 15'	225 ,, ,,
19 Maceration room	—	15' x 15'	225 ,, ,,
20 Departmental Library	—	25' x 30'	750 ,, ,,
21 Departmental Office	—	20' x 25'	500 ,, ,,
22 Common room	—	30' x 25'	750 ,, ,,
23 Seminar room (3)	—	20' x 20' x 3	1,200 ,, ,,
			16,525 ,, ,,
			5,858 ,, ,,
			22,500 sq. ft. (approx.)

N.B.—(i) Add 33.1/3% for passage, corridors, stairs, lavatory and bath.
(ii) There is no provision here for animal house and lecture theatre which would be common for all departments.

LIST II

Department of Anatomy (Departmental Staff)

A) Teaching Staff:

Professor & Head of the Department	1
Readers	2
Lecturers	3
Research Scholar	1
Extra-mural Part-time Teachers	5
	12

B) Non-teaching Laboratory Staff:

Laboratory Assistants	5
Laboratory Attendants	5
Artist-Photographer	1
Modeller	1
Technicians	3
Taxidermist	1
	17

C) Departmental Office Staff:

Office Assistant (knowing typing)	1
Steno-typist	1
Store-keeper-cum-Accounts Asstt.	1
	3

D) Lower Subordinate Staff:

Bearers	2
Domes	3
Sweepers	2
Peon	1
	8

LIST III

List of Apparatus and Equipments required for the Department of Anatomy

X'Ray Apparatus (1) including micro-radiographic arrangement
View Boxes
Epidiascope (1)
Microtomes:
(a) Rotary (1)
(b) Rocking (1)
(c) Sliding (1)
(d) Base sledge microtome (1)
(e) Large section microtome (1)
(f) CO_2 freezing microtome
*(g) Ultramicrotome
Microscopes (10)
Dissecting microscopes
Phase contrast microscope
Polarised microscope
Stereo microscope
Binocular microscopes (2)
Microprojection apparatus (1)
Photomicrographic apparatus (1)
Embedding oven (1)
Vacuum embedding apparatus (1)
Thermostatic incubator (3)
Egg incubator (1)
Drawing apparatus (1)
Articulated skeletons
Loose human bones (complete) — 5 sets
Loose bones
Instruments & apparatus for physical anthropology
Refrigeration apparatus for mortuary
Automatic shaker
Deep freeze
Electric lathe and electric drill for workshop
Type-writer
Duplicator
Weighing machine (3)
Sartorius chemical balance
Distillation still
Accessories for quantitative histology
Refrigerators (2) — 10 c.ft.
General surgical instruments
Band saw machine (1)
Drilling & Saw machine (1)
Demonstration eye pieces (3)
Neuro-anatomical slides (1 set)
Serial sections of:
(a) Chick embryo (1 set)
(b) Pig embryo (1 set)
(c) Rat embryo (1 set)
(d) Human embryo (1 set)
Vacuum pump—electric (1)
Photographic equipments:
(a) Plate camera with flash and stand
(b) Rollicord film camera with photo-micrographic arrangement
(c) Photographic enlarger
Anthropological instrument set
Chemicals and reagents
Glassware
Models
Charts

35 mm. slide projector with automatic changer
Cine projector
Micromanipulator
Photostat machine
Other accessory photographic arrangement
Camera lucida
Operation table with fitting
Sterotaxic apparatus for producing lesion with diathermic needles
Flowmeter and outflow recorder
Tissue culture equipment and accessories
Additional sundries.

*For tissue-culture and histology laboratories, air-conditioning plant would be most helpful. This would also be useful for developing room for X-ray section.

BASIC AND SPECIFIC REQUIREMENTS OF A POSTGRADUATE STUDENT IN ANATOMY

DR. T. P. SINHA, M.B.B.S., M.S. (U. S. A.)
Prof. & Head of the University Department, P.U.

THIS is an important problem which needs to be given a thought in the postgraduate study not only of Anatomy but of all the medical subjects.

Postgraduate Study in the Past

Before I deal in detail with the requirements of a postgraduate student in anatomy, I should like to discuss what a postgraduate student in Anatomy or a postgraduate student belonging to any other subject of the basic medical science had to study for the postgraduate degree M.S. (Anatomy) and M.D. (Physiology, Pharmacology and Pathology). This was not long ago and even now does exist in some universities.

The major subjects in the Medical Faculty for the purpose of postgraduate studies were Surgery and Medicine and the voices of the surgeon and physician predominated in the framing of the regulations for medical studies. The professors were mostly F.R.C.S. or M.R.C.P., trained in the U.K., and they did not care to understand the conditions existing elsewhere. The universities therefore had to adopt the M.S. and M.D. degrees as the only degrees for postgraduate students in the Medical Faculty. Therefore, any student who wanted to take up a postgraduate course in Anatomy or in other basic medical subjects or even in the different sub-specialities of Surgery and Medicine had also to study General Surgery or General Medicine besides the specific requirements of his speciality.

Thus, during that period, the basic requirement of a postgraduate student in Anatomy or in other basic medical subjects was also the clinical knowledge of General Surgery or General Medicine On the other hand, the surgeons and physicians never considered the importance of introducing also an intensive training of foundation subjects, that is the basic medical subjects, side by side, during the postgraduate studies of a student of Surgery or Medicine. I am glad there seems to be an awakening and, it is likely, two parts in the postgraduate studies of clinical subjects may be introduced—Part I dealing with basic requirements and study of basic medical subjects, and part II dealing with specific requirements of the study of clinical subjects.

Renaissance

The next phase began when teachers well qualified and trained in Anatomy were available to join the Department. Thus, controversy arose between the revolutionaries and conservatives and ultimately there was a great change in the study of Anatomy and other basic medical subjects. In some universities, M.Sc. degree and, in some other universities, M.S. degree without examination in General Surgery was introduced. Ph.D. or D. Phil degree in

the subject was also introduced in some universities. Madras and Patna started tbe Ph.D. about 15 years ago and Calcutta and Assam have introduced D. Phil. a few years back. It is, however, not nice to have different names for the same type of degree in different medical subjects and the sooner it is removed it is better.

Rationalization of Postgraduate Degree

The M.S. or M.D. degree in India requires a comprehensive knowledge of tbe subject and practical experience comparable to F.R.C.S. or M.R.C.P. as also research knowledge in the line of Ph.D. The period required for this, however, is only two years. How then is it possible to achieve the objective in such a short period? M.S. and M.D. degrees in England, from where tbey have been copied, are only research degrees and only a thesis which contributes to the medical science is required. F.R.C.S. or M.R.C.P. is a specialist diploma and is given on the basis of adequate knowledge of the subject.

In order to assure the theoretical and practical knowledge of specialities and also the knowledge in the depth of research, I feel it is necessary to introduce two types of degrees for all subjects including the various specialities in the Medical Faculty.

(I) Master's degree in the line of the present M.S., M.D. or M.Sc. degree—This will entail comprehensive study and also practical or clinical knowledge of the subject. There may be a dissertation requirement at the most. This should produce a specialist and teacher with good knowledge of the subject.

(II) Research degree in the line of Ph.D. or D. Phil degree—This will entail intensive research on some problem. This should produce a teacher with searching mind.

With such rationalisation it may not be necessary to introduce National Diplomas which are under contemplation.

It is important to appreciate the above problems regarding the types of degree to be introduced in future in order to plan the details of the requirements of a student in his postgraduate study.

Inclusion of Non-medical Men as Teachers

There is still another problem which needs clarification before dealing with the requirements. This is particularly important for Anatomy and other basic medical subjects. I have seen in the Western countries that a non-medical man is a teacher in Anatomy and in some other basic medical subjects. Sometimes he is even a Professor and Head of the Department. In the U.S.A. a good percentage of teachers in these subjects are non-medical men. So far, non-medical men have not been encouraged in India to be teachers in any basic medical science subjects, although in 1951, the Patna University had introduced the M.Sc. (Medical Scienc) degree in Anatomy and Physiology to be given also to non-medical men provided they were B.Sc. in medical science. Madras University has recently admitted candidates who are graduates in science for M.Sc. degree in Anatomy and in other basic medical subjects. I think this scheme may work if the Government also considers appointing qualified non-medical men as teachers in Anatomy or in other basic medical subjects. This will be in line with the conditions existing in Western countries. I have seen that such teachers are well devoted to the subject and are also responsible for contributing to the advancement of medical science.

As the conditions exist now in all the different medical colleges of India, the departments of Anatomy and Physiology never have their full quotas of teachers. In some places, the Professor is the only permanent staff of the department. The others come and go. Many of them come because they are forced to come by the Government and others come willingly for their own benefit. They want places in the college in order to study for postgraduate degrees in clinical subjects. They leave the department the moment their purpose is served. In Western countries also, these departments could not attract medical men and as such there was always a difficulty in getting adequate number of medical men as teachers. Therefore, they accepted non-medical persons to be trained for being fitted as teachers.

Although I was trained in the U.S.A. and had also seen the training in the U.K. and the Continent where a good number of teachers are also non-medical men, I was still opposed to their coming as teachers in our colleges in India. But seeing year after year the pitiable condition of most of the departments of Anatomy and Physiology in this country and finding how these departments are exploited by teachers who are young medical men for their own gain, I am now convinced that the panacea lies in encouraging non-medical science graduates to take up postgraduate studies in Anatomy and other basic medical subjects and accepting them as teachers. I am sure if such teachers are given their dues in the departments, they will prove quite useful as in Western countries.

Planning of Requirements

It appears that in the matter of organising the basic and specific requirements of a postgraduate student in Anatomy, it is necessary to accept that (i) the postgraduate degrees are Master's degrees and Research degrees, whatever may be the name; (ii) a postgraduate student is a medical man or a non-medical man possessing the B.Sc. or M.Sc. degree. The B.Sc. degree may be in medical science which means the student has studied Anatomy, Physiology and Biochemistry.

MASTER'S DEGREE

The basic and specific requirement of study depends whether the Postgraduate student is:

(A) A graduate in medicine (M.B.B.S.)

(B) A graduate in Medical Science (B.Sc. Med.)

(C) A graduate in non-medical science subject (B.Sc., with Biology).

(A) A *Graduate in Medicine* (M.B.B.S.)

The master's degree for such students should be called M.S. and the requirements should be:

(1) Gross Anatomy (which should also include Topographic Anatomy and Radiological Anatomy)

(2) Neuro-Anatomy

(3) Developmental Anatomy

(4) Micro-Anatomy

(5) Applied Anatomy

(6) Elements of:

(i) Comparative Anatomy and Morphology
(ii) Genetics
(iii) Physical Anthropology
(iv) Vertibrate Palaeontology
(v) History of Anatomy
(vi) Forensic Anatomy
(vii) Technology in:

(a) Microscopy (various types)
(b) Histological techniques including histochemistry
(c) Photographic techniques including microphotography
(d) Radiography
(e) Cadaver injection—embalming
(f) Museum technique
(g) Animal keeping and breeding
(h) Perfusion technique
(i) Operative technique including anaesthesia
(j) Tissue culture
(k) Use of isotopes and geigicounter.
(l) Use of instruments like colorimeter, pH meter, chromatography and such other instruments which may be in use in the department.

(7) Elective subject for detailed study—students should elect any of the subjects noted under 6 (i, ii, iii, iv, v).

Students of M.S. in Anatomy must know the importance of Anatomy in different clinical specialities. It is therefore necessary to stress the knowledge of Applied Anatomy to them and it should form one full paper for them.

(B) Graduates of Medical Science (B.Sc. Med.)

The Master's Degree for such students should be called M.Sc. (Med.) and the requirements should be the same as for the students with M.B.B.S. They should be given the teaching of Applied Anatomy in the same way but there need be no paper in it.

Further, under group (A) in item (6) Elements of Pathology and in item (7) datailed study in Pathology should be included. However, the courses of Pathology should not be intensive and should be suitably adjusted to include general pathology, microbiology and parasitology. This will be useful for understanding diseases in the future career as teachers.

(C) Graduates of Non-medical Science Subjects (B.Sc.) with Biology

The Master's Degree for such students should be called M.Sc. (Med.) requiring orientation course in basic medical science subjects. As such their requirements should be:

(a) Orientation basic course

1. Introduction to Human Anatomy

2. Gross Dissection of Human Body
3. Microscopic Anatomy
4. Physiology
5. Biochemistry

The scope of knowledge on the above subjects at this level need not be high and the courses should therefore be adjusted to be completed in one year.

If non-medical men are also trained for the Master's course in other basic medical subjects like Physiology, Bio-chemistry, Pharmacology, Parasitology, Microbiology and Biophysics, then the same orientation basic course should form the common course for all of them.

(b) Specific course (course of specialization)

This course of study should be organised in the same pattern as the course of study for B.Sc. (Med.) students.

The duration of study for this group, therefore, should extend over three years—one year more than in other groups. It will be useful to integrate the teaching of Anatomy with the clinical subjects whereever possible.

RESEARCH DEGREE

The research degree should be called Ph.D. and the following should be the requirements:

(1) Only an M.Sc., M.S. or M.D. be registered for this degree.
(2) Duration of work should be at least two years.
(3) At the end of the above period a thesis to be submitted which should indicate the contribution to the advancement of medical science.

TEACHING OF ANATOMY TO POSTGRADUATES WITH SPECIAL REFERENCE TO NEUROANATOMY

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IN a fast developing country as ours the need for a large number of doctors has often been stressed. To that end our medical educationists have, therefore, very rightly stressed and suggested shorter teaching courses and broad-based curricula resulting in the fresh medico having acquired a good general knowledge of the clinical subjects and as much study of the preclinical and paraclinical subjects as would be necessary for a proper comprehension of the former subjects.

All this is perfectly justifiable, but to cope with the shortage of doctors we also need more medical colleges which in turn need properly trained teaching personnel to man them. And we have to have more teachers with postgraduate qualifications and that is why the problem of postgraduate teaching demands our serious consideration, the more so since we have allowed teaching standards in the undergraduate stage to go down in the larger interest of the country. Specially is this true for anatomy not only because the number of trained teachers is very limited but also because it is rarely that really good students take up anatomy as their career in view of the many other and more lucrative openings available to the fresh graduate. Be that as it may, the problem of properly tackling the postgraduate students of anatomy is a very real one and has to be tackled with our best efforts.

It is, however, important to clarify what standard of knowledge to expect from our postgraduates. Of course, opinions are bound to differ on this point, but keeping in view the limited time at his disposal, since most institutions have a postgraduate degree course of two or three years' duration, he should be expected to possess a good general knowledge of anatomy in its various aspects, like neuroanatomy, morphology, anthropology, embryology, etc., and it would hardly be correct to expect that he would be a master in all these branches. In view of his future assignments as teacher of undergraduate students mainly, it is imperative that his course of study include a good grounding in topographical gross anatomy with a bias towards application of anatomical knowledge in surgery and medicine. Once a teacher of anatomy has acquired a sound knowledge of the principles of anatomy and has practised the basic anatomical technics and develops a proper outlook on the subject, which depends naturally on his interests and sincerity of interests, he can gain further experience with the passage of time. It must never be lost sight of that our postgraduates have primarily got to be teachers of anatomy for the coming generation of undergraduate students and only a very few of them may turn to pure research work.

very often they do. In addition, they should be taught like regular students every day. One is liable to consider postgraduate students in terms of their official designations such as demonstrators, tutors or even lecturers. We forget that they really are students who are as much in need of our constant guidance and teaching as others.

Not very long ago did we have the good fortune to witness the very interesting demonstration of the teaching methods of Prof. Russel Woodburn of the Michigan State University, remarkable for its simplicity and effectiveness. He discussed the gross topographical anatomy of an area in a lecture followed, after a short coffee break, by a three-hour dissection of the same portion. It only requires a very sustained effort on the part of our teachers to make it a success. If the postgraduate students also attend such a lecture and if the teacher, over a cup of coffee, discusses the higher aspects of the topics like morphology, embryology and recent advances and views, then we can gradually cover the postgraduate aspects of the anatomy of the whole body without any perceptible extra effort.

I do not wish to underrate the value of seminars and discussions wherein the postgraduates prepare special topics in great detail followed by equally hair-splitting discussions; but in this way they can hardly be expected to help in an all-round development of knowledge of the subject, whereas when a postgraduate is taught along with the others, he studies the entire body in good detail and practically with no strain whatsoever.

As regards the teaching of neuroanatomy to postgraduates, while it must be stressed that this subject is dealt with rather cursorily in the undergraduate stage and so merits greater attention now, I do not feel that it merits all our attention. From my limited experience of twenty years of teaching and examining I can say that in most postgraduate courses too much emphasis is placed on neuroanatomy and morphology followed by embryology as a close second, usually at the cost of topographical anatomy including living and surface anatomy. These latter aspects, one can understand, are usually the most important from the clinical point of view, and should be the primary concern of the future undergraduate teacher.

Since neuroanatomy and neurophysiology are so closely interrelated, it is advisable that students of both these courses should get together in this study so that they may be mutually benefited.

It had immensely benefited students in our college to begin with a preliminary dissection of the human brain with the aid of any standard dissection manual of practical anatomy. This gives a firm foundation on which to build up as studies advance. Unfortunately, very few institutions would insist on such an elementary though exceedingly useful procedure.

It would be certainly better if students also dissect for themselves a series of representative vertebrate brains; but the short time that is available to a student makes rather difficult for him to perform all the dissections and we must content ourselves with only a museum study of such material. Special emphasis should be placed on macrosomatic brains with a view to elucidating the finer points of human rhinencephalic structures, so very baffling to the uninitiated.

The internal structure of the brain, and specially of the brain stem, should next be studied on prepared slides easily available in any laboratory, failing which these can readily be prepared by the students themselves. It is not very difficult to stain with some of the simpler Weigert-Pal modifications like Loyz, etc., and even paraffin-embedded material works quite well for

our purposes. It is to be stressed that no amount of Kodachrome projections can replace the study of actual slides and the study of the different histological characteristics of the various functional cell groups, which greatly help in understanding their connections.

After the student has gained a good, general idea of the main masses of grey matter and nuclei in the brain, the teachers of anatomy and physiology can get together and give a few lectures elucidating the main nerve fibre pathways and connections. Line drawings and other audiovisual aids are very useful for this purpose. It would certainly be very desirable if at this stage some sort of a liaison could be established with the neurophysician and surgeon and the students be afforded an opportunity to study actual cases of nervous lesions in order to correlate theory and practice, thus having better understanding with less strain on memory. This, unfortunately, cannot always be achieved with the best of our intentions.

It is presumed that neurohistology would be taught along with other histological teaching where it rightly belongs.

It would at once be clear from the above that no special stress is laid on experimental procedures involving nerve degeneration and regeneration experiments. Nor has emphasis been laid on the specialised silver and other neurohistological staining techniques since these should, more appropriately, be relegated to the curriculum of those specifically engaged in research projects with research degrees in view. Whereas there are many institutions where such specialised techniques are practised in a more or less routine manner and whereas there are students who certainly benefit by acquiring proficiency in them, but to expect that postgraduate students everywhere should master them as a matter of course would not be quite consistent with the idea outlined in the very beginning, namely, our postgraduate student should be well versed in a general way in all aspects of anatomy, including neuroanatomy, thereby acquiring a broad and intelligent outlook on the subject. A pure research worker on the other hand has his specific requirements quite different from those of the specialist teacher, which need not be discussed here.

EXAMINATION AND ASSESSMENT OF THE POSTGRADUATE IN ANATOMY

DR. V. SITARAMA RAO, M.B.B.S., M.SC.
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ASSESSMENT of a postgraduate in anatomy depends upon three factors: the objects to be achieved by a trained candidate, the grading of the degrees and whether the candidate is a medical man or a non-medical person. Let us consider them separately. The objects to be aimed at in training a person in non-clinical courses like anatomy are: first, to equip him to teach undergraduates at a later period; secondly, to impart instruction in the speciality to postgraduates of other disciplines; and, thirdly, to give him training for the running of the department. The following are the postgraduate degrees that are awarded in India: M.Sc., M.S., M.D., Ph.D. and D.Sc.

The first three degrees are considered necessary for promotion to a professorial rank in any medical college. Different universities are awarding one or the other of these degrees and they can be considered to be of about the same standard.

"The purpose of evaluation is not the assignment of some alphabetical or numerical label to a student's achievement or ranking him among his peers. It is only a by-product of the process." Therefore, the important purpose of evaluation is to see how much a student learned and how much he had yet to learn and whether he can be certified as having learned enough for the task he has to perform. A teacher in anatomy is expected to have basic concepts of all the branches of the subject. He has to acquire the practice of sound reasoning and critical judgment He should have an open mind so that he can absorb new knowledge judicially and dismiss outdated information. He must evince scientific curiosity for doing research. In the beginning he must learn the methodology of correct approach to a problem and has to be familiar with the usual techniques of work.

How to evaluate the knowledge for giving certificates ? Should there be a fixed syllabus for the course ? Who should examine the candidate ? Is it enough if the teacher, under whom he is trained, be his examiner ? What should be the nature of examination ? Should there be written, practical and oral tests and a dissertation or thesis for a postgraduate course ? All these are required to be decided. There should be only a general syllabus and no definite text-books prescribed. A postgraduate student should be alive to the new literature on the subject and has to be familiar with current contributions and literature pertaining to various branches of the subject. He has to develop a wider concept of the subject.

Though it is accepted by many that the professor under whom a candidate works knows fully about him and can evaluate his knowledge for certification, this method has some inherent disadvantages and may in some cases be hazardous. Therefore an external examiner can remove the defect and he will be able to discharge the onerous duty of responsible certification in a better manner.

The need for a thesis or a dissertation for certificatinn for a would-be professor in a medical college in this country need not be emphasised. The habits nf curiosity and creative thinking must be inculcated in the minds of undergraduate students, which can be achieved only when some research programme is pursued in the departments of the college. Teaching and researcb are not separate disciplines. The thesis may not be of a high standard for the first qualifying postgraduate examination. The anatnmist has to stimulate the habit of inquiry in the mind of a young student.

Though some criticise the adverse influence nf examination, it is absolutely necessary at present in the absence ot any better metbnd of assessment. The person with a postgraduate degree has to teach the student in all branches nf the subject. Hence, there is need to test his skills in the techniques and tbe amount of his learning by way of an examination. There should be a written examination and a practical examinatinn in dissection and histology and viva voce.

With the introduction of modern techniques in medical education, it is likely that the emphasis on anatomy at the undergraduate level will be less than at tbe postgraduate level. Anatomical knowledge is basic to all medical sciences and a postgraduate student in anatomy should be equipped with sufficient knowledge so tbat he can discharge his duties efficiently when be occupies a professorial cbair. So, the written examination should test the ability of students in gross anatomy, embryology, histology, neuroanatomy, applied anatomy, basic knowledge of genetics, heredity, comparative anatomy, morphology and anthropology.

It is desirable tbat tbe question papers are set by external examiners. Assessment of the answers, the practical tecbniques and viva voce have to be conducted botb by the internal and external examiners. Optimum number of examiners will be two external examiners and one internal examiner. Tbe performance of the candidate has to be judged as a whole instead of marking at every stage. Though it may appear tn be desirable to have an all-India Board for conducting the examination, several practical difficulties outweigh the advantages. In the case of non-medical candidates, tbe amount nf knowledge expected regarding applied anatomy has to be limited.

It is desirable to award M.Sc. degrees in anatomy to non-medical men and M.D. or M.S. degrees to medical men. It is also worthy nf consideration to decide on an all-India basis whether there should be an examination in clinical medicine to justify the M.D. or M.S. degrees.

To have good teachers in medical colleges, Ph.D. or D.Sc. degree has to be awarded only to candidates who have previously taken M.Sc., and have conducted research work under a suitable teacher for a minimum period nf 2 years after M.Sc. The thesis has to be submitted to a panel of three examiners. For awarding D.Sc., the work should be of a very high order and should make a definite contribution to tbe existing knowledge on the subject. The examiners who evaluate should be tbose wbo are pursuing work on tbe same or allied problems in other countries.

In conclusion, it may be stated tbat tbe postgraduate degrees in anatomy in India should conform to international standards and in no way should they be inferior to those granted in advanced countries.

THE MODERN TEACHING MUSEUM OF ANATOMY

DR. I. P. AGARWAL, M.S.
G. R. Medical College, Gwalior

MUSEUM, a word of ancient Greek origin, meant to convey in the times of Plato "a temple of Muses—the nine sister goddesses to whom inspiration in learning and art was attributed." In 323 B C. the term was associated with schools for arts including philosophy. Such was the idea in naming the Academy of Ptolemy Soter as Museum. Amongst the Latins the word "museum" meant a library. The meaning of the word in the 17th century was storehouse of the treasures of art and various crafts. In England, the use of the word dates back to 1615. However, the word has always conveyed an impression of its close affinity with the original meaning.

The arrangement of any museum has reflected much of the attitude towards the natural world current from time to time, and until late 18th century the museums were designed rather to gratify sight than to improve understanding. The very pattern and organisation of museums has altered itself so much through the ages that today it is desirable, though not yet completely feasible due to traditional bondage, that the museum should serve as a library and a teaching laboratory full of Nature's own original documents. It is expected to be as full and complete a collection of natural objects as can be obtained, where an inquirer can pursue, turn over, spell and read the book of Nature critically.

The major limiting factor in the development of museums in olden days had been the ignorance regarding the proper means of preservation of such bodies or parts thereof which soon spoil or putrify. This state persisted until Formalin, a German discovery, was first prepared by a Russian chemist, A. M. Butlerov, in 1859 and was identified as a preservative in 1867 by A. W. von Hofmann. Before this, the human anatomical material other than bones was sparse in early museums.

Today, with greater knowledge of the chemistry of living tissues and the process of chemical death as opposed to that of the physical death, the preservation of dead tissue in a state of *maximum attainable resemblance to its live counterpart has become a practical possibility.* If a collection of human material, preserved in this manner, is made available to students, then it can adequately supplement, if not wholly replace, his laboratory work in the dissection hall. The necessity of having a good anatomical museum is felt more because of the ever-increasing dearth of cadaveric material for laboratory use. Realising the undoubted value of a teaching museum, the more technically advanced countries have already instituted full-fledged courses of *Museum Technology*. The personnel thus trained will in due course take over the responsibility of manning the organisation of museum and this will help to develop the museum technology.

The organisation, pattern and collection of any museum is largely dependent on the vision of its initiator. The individual traits, though they limit standardisation, add to the variety without seriously affecting the basic minimum requirement of a museum.

The utility of any teaching museum will be directly proportional to the comfort it can offer to the user. It is not only desirable but essential to have a museum profusely lighted artificially. Natural light discolours the liquid-mounted specimens besides posing a problem round the clock. In the hotter climatic regions it is preferable to have the place airconditioned to prevent dust and undue dehydration. It may prove to be a costly venture initially but in the long run it saves considerably on man-hours spent in dusting each specimen, remounting it after replenishing the fluid content which may never attain the desired chemical composition once again unless completely replaced, costing more than the initial investment. Similarly, it is advantageous to have the place rendered relatively noiseless by providing cork flooring. From the point of view of architectural construction, the shelf system affords the maximum space for lodging specimens in any moderately sized hall. Shelves made of transparent plate glass on rustproof painted angle iron frames would provide the least interference with light from different directions without very much increasing the cost of construction. For liquid mounting the plastic jar is preferable to a glass jar for the wide range it offers on the size of jar besides its superior transparency and non-brittle characteristic In order to improve its appeal to the student and guarantee its use as a teaching museum, it is essential to avoid heaping an inaccessible, crowded regiment of identical specimens, else it will serve only as a storehouse.

A museum intended to serve as a laboratory has to be staffed adequately like any other useful laboratory. The staff should include at the basic minimum, a curator, a museum technologist and two preparators, all working as a unit under a departmental head. To these members should be assigned the duties of selection, preparation, mounting, labelling and cataloguing each specimen. For the use of this staff, there should be rooms attached to the museum with fittings of appliances like band-saw, plastic jar-making outfit, mounting shelves, gas and water tap connections. These rooms plus one room for the museum secretary need preferably be provided with natural light to avoid strain on the eye during long working hours. The museum secretary can be in charge of the catalogue, prepared with full reference to case history, description of specimen accompanied by a suitable illustration or photograph.

Since a separate museum for the postgraduates is not comprehensible, within the same premises space has to be allocated for the exclusive use of the postgraduates. Each museum should have a section of neuro-anatomy adequately furnished with dissections and sections using various stains. It will be useful to present, therein, specimens showing brain and nerve lesions, preferably obtained from animal experimentation.

The gross anatomy has to be displayed regionwise, making available, as best as possible, dissected parts from all over the body. Some parts like bronchopulmonary segments, renal segments, liver segments, etc. may have to be exhibited as plastic casts if these dissections can not be made easily.

The embryology section should endeavour to put up as many normal embryos of different intra-uterine ages as can be procured in a preservable state from the maternity wards of the attached hospitals. Since a collection, made in this way, is not likely to show all the stages of development of different systems, it is necessary to have models prepared of clay plastic, etc. Spalteholtz preparations with different systems identifiably stained serve useful purpose,

The teratological specimens have to be shown fully dissected along with an explanatory note on each observed abnormality.

The spalteholtz preparations showing ossification centres along with radiographs of postnatal ossifications serve as useful aids to impress on the students the medicolegal application of anatomy without very much taxing their memory.

A full corner devoted to the normal radiology section should, besides showing the fully ossified and unossified bones, also iodicate the impressions of soft tissue shadows. The alimentary and urinary systems cao be represented by contrast medium radiography. The skiagrams obtained from higbly specialised techniques like angiography, ventriculography, portal venography aod radioisotope location can be set aside for use of the postgraduate student only. Many of the developmental disorders can be best explained radiographically.

It will be useful if a section of the museum is devoted to the anatomy of the various surgical diagnostic and therapeutic procedures, iocludiog extensile exposures based on anatomical facts. An entirely full section will have to be earmarked for national and international history of aoatomy followed by specimens or models depicting comparative anatomy and its evolution leading finally to the sectioo of anthropology. It will be desirable if the methods used in deriving the anthropological data are also available to the postgraduate student.

Regarding the place of histology in anatomy, opinion is divided but at a postgraduate level its essentiality is accepted universally. Besides displaying the histological appearances as photographs and slides including electroo microscopic details, it is a definite advaotage to make available a good collection of slides and a microprojector in a darkroom in the museum.

Finally, a word for the overburdened student. Can we reorientate our existing pattern of compartmentalisation of museums into a centralised affair? Herein, the student could develop an insight into the deranged aoatomy and physiology, along with its normal, for comparison. I trust, in this way, pathology will be more comprehensible and better appreciated both by the raw and the would-be expert students. Administratively, such a museum could be governed, staffed and managed by a body with equal representation from either side. The idea, in any case, is io keeping with the ideal dream of integration which is aired by many but as yet practised by none.

THE TEACHING OF LIVING ANATOMY

DR. S. ACHAYA, M.S., D.G.O., F.R.C.S.

Professor of Anatomy, Lady Hardinge Medical College, New Delhi

THOUGH we have gathered here to discuss the various problems concerning the postgraduate teaching of anatomy, I propose to first comment on the problem of teaching living anatomy to undergraduate medical students. At this level there can be no doubt in the mind of any teacher about the need to stress this aspect of anatomy, though, regarding the method of teaching the subject at the postgraduate level, there are certain problems, some of which are controversial.

For the undergraduate medical student, while dissection of the human cadaver must remain the main approach to anatomy, much can be learnt by the examination of the living subject using the methods of inspection, palpation, percussion, auscultation, radiology and endoscopy. This method of teaching anatomy is more important now than it was in the past, because with the reduction of the M.B.B.S. course to four and a half years of study, and a year of compulsory housemanship, the medical student has little time to spend on first learning the preclinical subjects as individual entities, and then integrating them with paraclinical and clinical subjects as he proceeds with the course. If the two are integrated early in his training in a simple way, this difficulty is overcome. Living anatomy is also graphic and "human," and therefore easily awakens the interest of the student. Whether living anatomy should be taught by the anatomist or the clinician is a controversial point, and I will take it up later.

Postgraduate Teaching

What is its aim? I think it will be agreed that the aim is to produce competent teachers and research workers.

The candidates who enroll for postgraduate courses in anatomy may be placed in three categories: (i) those who soon after graduation start work in the departments of anatomy of medical colleges and are registered for postgraduate courses; (ii) those who find time to enroll for a postgraduate course, after having spent several years in district hospitals (the number of such candidates is small but not negligible); and (iii) the non-medical postgraduate student.

Of these, candidates belonging to category (i) have fresh knowledge of "living anatomy" which they gleaned as undergraduate students in teaching hospitals; and just having done jobs in various clinical departments, their knowledge of the applied aspects of anatomy is up to date. The candidates in category (ii) are quite out of touch with the methodology and interpretation of radiological and endoscopic examinations; and of several other aspects of living anatomy and hence they will have to refresh their knowledge of these and of rare congenital deformities and manifestations of disorders of the nervous system, such as are seen in larger and better equipped hospitals. (iii) The non-medical postgraduate student

has little knowledge of living anatomy, and in teaching him, the approach will have to be modified, though this aspect of the subject should by no means be underemphasised.

The next consideration which will govern the methods to be used in teaching and the emphasis to be placed on "living anatomy" will depend on the particular postgraduate course that is to be catered for.

Postgraduate education in the basic medical sciences in India aims at the acquiring of one of the following degrees: (1) Master of Surgery (Anatomy); (2) Master of Science (Anatomy); and (3) Doctor of Philosophy (Anatomy).

M.S. and M.Sc. Degrees

Master of Surgery is to my mind an unfortunate designation for a degree in which the candidate has specialised in advanced anatomy, because the term "Master of Surgery" gives the erroneous impression that the possessor of the degree has had advanced surgical training and experience. On the other hand, the degree of Master of Science in anatomy leaves the owner of the degree with a disadvantage, because he is equated in the university with an M.Sc. in any of the other sciences. An M.Sc. degree in science can be obtained five years after the student has passed the higher secondary or Indian school certificate examinations, while the minimum time required to obtain the M.Sc. degree in anatomy is eight and a half years. I have always felt that a nomenclature which gives these inaccurate impressions should be rectified, and this can be done by designating this degree in pre- and para-clinical medical sciences as Doctor of Medicine (M.D.) with the speciality indicated within brackets.

A Digression

At present, for the M.S. and M.Sc. courses, some facets of living anatomy are taught in that the applied aspects of anatomy are stressed at formal lectures and demonstrations are arranged in which both skiagrams and endoscopic instruments are discussed. However, as far as my experience goes, no effort is made to obtain interesting clinical cases for demonstration, or to work in association with the clinicians; and the student may or may not attend clinical meetings. The reason for this state of affairs is that the majority of candidates doing postgraduate courses are working full time on the teaching staff of the department of anatomy and, with the large numbers of undergraduate students whose training has to be catered for, there is little time to attend the hospital teaching rounds. Also, in most medical colleges the number of teachers in both pre-clinical and clinical departments is barely sufficient to teach undergraduates, and the postgraduates are largely left to fend for themselves.

However, these difficulties are not insuperable, and may be overcome by coordination between the anatomist, the physiologist and biochemist, and the clinicians. Clinics can be arranged for postgraduate students in anatomy once a month, if not oftener, where all the teachers of the specialities mentioned above would engage in discussions on interesting clinical cases, with the postgraduate students participating Congenital deformities, neurological defects due to injury or disease endocrine disorders bone and joint injuries, and cardiovascular disorders will be the classes of cases of most interest to a postgraduate student specialising in anatomy, and living anatomy can be discussed in relation to such cases.

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I am firmly of the opinion that in the teaching of "living anatomy" the clinician should take the major role in demonstrating and explaining the applied aspect of the case presented, and the anatomist may be called upon to clarify anatomical details. Most senior teachers of anatomy have not handled patients for several years. Moreover, they have to keep abreast of the latest advance in the various branches of anatomy as a pure science. The clinician is, therefore, in a better position to teach living anatomy. In the case of congenital deformities, the interests of the clinician and the anatomist are different. While the anatomist is interested in explaining the failure in developmental processes early in embryonic life, that led to the deformity, the clinician, on the other hand, is more interested in how best to correct the deformity and get the most satisfactory functional result, irrespective of how the deformity actually arose. In such cases, the postgraduate student can benefit by presentation of both the aspects of the problem.

This leads to an extremely controversial subject, and that is the role of non-medical anatomists in the training of postgraduate students in anatomy.

At the undergraduate level, where the emphasis is on integration of teaching—horizontal, vertical and oblique (I use those terms with hesitation because I fear they have been overplayed)—of pre-clinical, para-clinical and clinical subjects, the non-medical anatomist will not make the best teacher. However, at the postgraduate level, a non-medical teacher can be usefully employed, provided the clinicians can take over the teaching of living anatomy.

The Ph.D. degree is awarded to a candidate who, after having qualified for the M.S. or M.Sc., has done research of a high standard. For these students, the question of teaching living anatomy does not arise. Modern trends in research in anatomy involve microscopy at high magnifications, and advanced histochemistry and these are extensions of pure science which can best be tackled by the non-medical anatomist. In two other fields, namely, experimental anatomy and physical anthropology, advanced research is within the scope and ability of both medical and non-medical anatomists.

Diploma Courses

Lecture-demonstrations in anatomy are also given at the postgraduate level to students enrolled for diploma courses in various medical specialities. These lecture-demonstrations should be given by anatomists using anatomical specimens, but the living aspects of anatomy for such courses are best dealt with by the clinician.

To sum up, the teaching of living anatomy to postgraduate students is important, but is not given due emphasis in the courses which are organised at present. The teaching of anatomy should be the combined effort of both the clinician and the anatomist.

Non-medical teachers of anatomy may be employed in medical colleges mainly for the training of postgraduates at the Ph.D. level when the teaching of "living anatomy" has been completed.

TEACHING OF ANATOMY AND SURGERY

Dr. B. N. Balakrishna Rao

It is interesting to find that amongst the various branches of medical science it is surgery and surgical technique that have been recorded in ancient fable and phrase. It must be assumed that even the primitive man must have had some knowledge of anatomy, because surgery, however gross and incomplete, is ever based on the science of anatomy. This knowledge was obtained, as is to be expected, from the slaughter of animals for food. While hunting, he came to know the vulnerable areas of the animal and cannibals and it gave him information of human anatomy. With this background-knowledge of anatomy obtained purely in the process of survival of the primitive man, surgery developed as a byproduct. Having a knowledge of anatomy, the primitive surgeon was able to prognosticate which injury would be dangerous and which had a chance of healing.

However, it was not till the dawn of recorded history that more precise knowledge of the position of various structures was obtained. Both in primitive and civilised epochs the surgeon had always enjoyed the opportunity of seeing the structures of the living body, as the study of anatomy in the dead body did not find favour for many centuries due to diverse causes, such as religious scruples, the practice of cremation, public sentiment and so on. It is only about the 15th century that bodies of criminals who were hanged were occasionally made available for public dissection. Throughout this period, it was the surgeon who also combined the role of the anatomist. Even as late as the 18th century and the early part of the 19th century, it was not uncommon for the surgeon to demonstrate a dissection of the dead, and then to operate on the living straightway. Later, however, with increasing demands on the surgeon for more intricate surgery and *more daring attacks on the living body*, there arose a need for more detailed knowledge of the structure and function of the human body. Thus, the anatomists formed a separate class by themselves and confined their attention to the arrangement of the body. The surgeon, on his part, relied on the information and teaching of the anatomist for his surgical procedures.

In the field of embryology as well, the surgeon has been able to demonstrate various abnormalities and developmental derangements. The anatomist, on the other hand, has also shown developmental abnormalities which, till very lately, as in the case of the heart or lung, were not surgically accessible. Thus, the development and growth of anatomy and surgery are interdependent. Many a malformation, for instance, observed by the surgeon is possible to explain by an understanding of developmental anatomy.

Before the role of the surgeon in the teaching of anatomy is discussed, it is pertinent to know why anatomy should exist and be taught as a discipline. It is also necessary to understand why and how much anatomy is useful to the surgeon.

Any discipline may be learnt for its own sake, to satisfy curiosity. But the knowledge may be turned into account for something materially useful or practical. The idea of

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become popular, but it may be useful if such chairs are established to the mutual advantage of the students of anatomy and surgery.

While it is desirable that the surgeon should be closely and actively associated in the teaching of anatomy, it is also desirable that the student and teacher of anatomy should be familiar with the anatomical structures of normal and abnormal conditions of the living body. A greater awareness of opportunities of observing and teaching living anatomy in the operating room needs to be developed.

To those who wisb to develop the knowledge of anatomy as a mental delight, there is ample opportunity, but to the surgeon such a knowledge can only be a means to an end.

knowledge for the sake of knowledge may serve its useful purpose. While a few may appreciate the detailed knowledge of anatomy, many prefer to look at these from the pragmatic point of view. By and large, it is generally accepted that the accumulated knowledge of the so-called basic sciences derives the ultimate utility and value because it helps to treat a sick person. That being so, the knowledge of anatomy and its ancillary subdivisions must be so motivated as to serve the needs of the clinician, be he a paediatrician, internist or surgeon. The surgeon by the very nature of his vocation should have access to various structures, whether superficial or deep, vulnerable or vital. Therefore he must maintain a continued and abiding interest in the knowledge and, consequently, in the teaching of anatomy. Tradition too shows that it was the surgeon who in the beginning started as a teacher of anatomy.

The surgeon then must naturally take interest in the teaching of anatomy. There appear to be considerable differences regarding these matters. Anatomy, for its own sake, is an admirable subject of study and those whose aim is to learn the subject for its own sake can pursue the study to their delight. Such people need not be medical personnel. But if, on the other hand, anatomy is to be taught as a useful subject, then the teacher should have to be a medical person, whose ultimate aim would be the treatment of the sick and wounded. It stands to reason, therefore, that if the aim of teaching anatomy either at graduate or postgraduate level is to tend the sick, the teachers should be medical men who have taken anatomy as an avocation and not as pure anatomists with no clinical background.

If it is agreed that the teaching of anatomy should be undertaken (a) by persons who have had clinical background and (b) that the teaching should be useful in practice and not an ornamental decoration, then we must know who are the persons best suited to teach and what must be the content of training.

When knowledge of anatomy as well as that of surgery was limited, the teaching of both anatomy and surgery was performed by one individual. With rapid growth of knowledge of both the disciplines, it became necessary to teach these subjects by different specialists. In spite of this division of labour, the intimate relationship between surgery and anatomy has never been strained. On the other hand, the surgeon is becoming more and more dependent on the anatomist, as for instance in the delineation of the anatomy of the liver or lung or neuroanatomy, for the understanding of many surgical approaches and surgical procedures. The anatomist, on his part, has to be ever alert as to the needs of the surgeon and be of use in the design of surgical procedures and access, not to speak of deformities and function. Therefore, it appears that the content of teaching of anatomy should be so oriented that it could facilitate the task of the surgeon.

A moot point is who should teach anatomy. On account of complexities and technical demands, both on the surgeon and the anatomist, it is unwise and impossible that one person should undertake the responsibilities of both. At the same time, in the ultimate analysis, if all the knowledge of anatomy has to be passed on to the surgeon, it is reasonable to expect that the surgeon should have a greater and more intimate responsibility in the teaching of anatomy than is the practice at present. Some universities had instituted a chair of Professor of Living Anatomy, the teacher being a practising surgeon. For some reason or another, it has not

It is realised that an academic crisis exists in the field of anatomy in India due to certain serious defects. The members were appalled by the dearth of staff and poor quality of personnel coming forward in the teaching department, due to which postgraduates are invariably used for a big load of routine undergraduate teaching. This comes in the way of undertaking adequate postgraduate training programmes to bring anatomy in India to modern levels even in future. Further, postgraduates are not coming forward as trainees. The following remedies are suggested:

All available resources in personnel and equipment in the different institutions of the same locality may be pooled together and utilised by inter-collegiate and inter-departmental coordination and cooperation.

It is recommended that after the existing sanctioned posts are filled up in the colleges, additional staff may not be necessary for the training for the first postgraduate degree in anatomy. However, for the second higher postgraduate degree, such as Ph.D., available specialists in any branch of anatomy will undertake only that speciality for training.

The Committee felt that, in an institution where only postgraduate training is undertaken, working units in as many branches of anatomy as possible may be established depending on the availability of expert personnel. The ranks of professors, readers and lecturers may be considered adequate for recruitment of expert personnel. An administrative head is considered essential.

There must be a separate teaching cadre with higher pay for senior appointments. Junior posts, such as demonstrators, may, however, be interchangeable with general line posts.

Senior staff should not be transferred unless on promotion or at their own request in the academic and economic interest of the department. If a promotion is due to the head of the department, he may be paid the salary of the higher post, but he should be allowed to continue in his existing post if he so desires. This is to discourage the tendency on the part of a scientist to take up an administrative post.

Salary scale of non-clinical professors and other staff must be as recommended in the Mudaliar Committee Report. Salary scale must be raised and made uniform throughout India.

The retiring age of non-clinical professors must be the same as that adopted in the universities.

Private practice should not be allowed to the teaching clinical departments as well as non-clinical departments. This will facilitate recruitment for the non-clinical departments.

The members felt that before further increase is made in the number of medical colleges, the deficiencies in the existing colleges must be rectified.

REMEDIAL MEASURES SUGGESTED TO ATTRACT YOUNG MEN TO TAKE ANATOMY AS A CAREER

A junior with postgraduate qualification should at least once in three to five years be sent to other institutions within India to get additional training in the first instance, and, for such training as is not available in India, they may be sent abroad.

REPORT OF THE SUBCOMMITTEE ON ANATOMY

IN the deliberations of the Sectional Seminar on Anatomy the Committee discussed the different aspects of the postgraduate training. It took stock of the modern trends in anatomy as against the existing conditions in India in this field.

The Committee discussed initially the area and content of modern anatomy which formed the basis for organisation of a department for postgraduate training. The Chairman detailed what broadbased anatomy training should include, considering anatomy as essentially human biology. The following subjects comprise anatomy:

The first group deals with the historical aspect of anatomy and consists of palaeontology, physical anthropology, comparative anatomy, genetics, human and comparative embryology, and principles of organic evolution. At naked eye observational levels the subject will include gross and topographical anatomy, radiological anatomy, forensic anatomy, with emphasis on living anatomy as against cadaver anatomy. The next group forms the study of anatomy at higher magnification of vision and includes histology, cytology, ultra structure, cytochemistry, and molecular biology extending to the field of biochemistry without any barrier.

The relation of anatomy to allied basic subjects in the postgraduate training was discussed. The absence of barrier between anatomy and physiology, anatomy and biochemistry, and anatomy and pathology is recognised. The historical aspect of anatomy as the basis for human biology has to be kept in view in framing postgraduate programme. The profound influence of modern development in pure sciences on anatomy is to be taken into consideration in postgraduate training. The competency in both teaching and research activities as the goal of postgraduate training was emphasised.

In the organisation of the postgraduate department, it was felt that all branches of anatomy cannot be brought into functioning units in all the medical colleges. The departments undertaking postgraduate training should have at least the following four basic sections:

1. Gross Anatomy
2. Micro Anatomy
3. Developmental Anatomy
4. Neuro Anatomy

No postgraduate course should be allowed unless these four fundamental sections are established on a sound basis.

EXISTING CONDITIONS

The medical colleges in India have the primary duty of training undergraduates on a large scale at this period of the development of India. As a result, there are serious limitations to research activities and postgraduate training in these institutions. Further, modern anatomy has branched into a number of specialised fields having a vital role to play in all fields of modern medicine, and yet gross and topographical anatomy which comprised a major part of the anatomy of the 19th century continues to be the main pursuit in 1965 in practically all medical colleges.

personnel and material. This is a new concept with regard to the role of museums in the training of postgraduates.

With regard to the role of anatomists in postgraduate training in clinical specialities, the members felt that the syllabus should be framed by mutual consultation between the respective heads of the anatomy departments and of specialities, and all problems regarding training and examination may be considered jointly.

Reasonably high salary and residential quarters for the staff should be provided as far as possible within the college premises or nearabout, which will be an additional inducement to the recruitment.

The Committee also recommended that a postgraduate student undergoing postgraduate training should be given adequate financial assistance in addition to the provision of hostel accommodation.

With regard to the degrees to be awarded after postgraduate training, all members agreed that a two-stage training must be given—the first being a broadbased one leading to the M S degree and the second stage leading to the Ph.D. degree; D.Sc. being still the higher degree should be awarded on the basis of original research work and publications. It is also suggested that for the first-stage degree, nomenclature may be made uniform as M.D.

DURATION

The first postgraduate degree of M.S. in anatomy should be permitted three years after full registration and the Ph.D. degree may be taken two years after the first postgraduate degree.

TECHNOLOGY

The members were painfully aware of the lag in technology in the field of anatomy. To remedy this it was suggested that emphasis be laid on the technological training in the postgraduate programme. Further, anatomy technicians should be trained, for which the requirements will be: (a) he must be a graduate in science; (b) he should have adequate training; (c) minimum duration of training should be at least two years; (d) during the period of training adequate stipends should be paid; (e) a certificate or a degree may be given at the end of the course; and (f) suitable scale of salary may be offered at the end of training.

LIBRARY FACILITIES

Enough budget allotment and foreign exchange facilities should be provided to enable the institutions to buy an adequate variety of journals and books.

They also felt that pooling of library services must be adopted in the interest of economy and to avoid duplication.

The members felt the urgent need for the enactment of Central Anatomy Act and that the provision of this Act must also be implemented firmly to enable the anatomy departments to get over the present shortage of cadavers.

MUSEUM

Members particularly emphasised the need for a well-organised comprehensive museum for all branches of anatomy including history of anatomy, as the modern anatomy museum can be utilised for teaching purposes which, to some extent, will compensate for the lack of teaching

ORGANISATIONAL PATTERN OF A POSTGRADUATE TEACHING PROGRAMME IN PHYSIOLOGY: PRESENT AND FUTURE

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POSTGRADUATE training in physiology in this country has been actively taken up only recently because no importance was given to it in the past in most of the medical institutions in the country. Even senior teachers in physiology were mostly appointed from amongst those who had the postgraduate training and degrees in medicine, and a large majority of them used this position as a stepping stone to teaching positions in the clinical sciences. Such teachers in our medical colleges were not much interested in doing research in the discipline of physiology, and they also could not inspire young medical graduates to take up postgraduate training in physiology. Except, perhaps, in the Calcutta University which gave the status of a science to physiology, postgraduate degrees in the science of physiology as such were not awarded by a majority of the Indian universities. Although the science degree in physiology in Calcutta University was open to all, not many medical graduates studied this subject and those who obtained this degree were mostly non-medical students. The few exceptions amongst our senior physiologists, who obtained a postgraduate degree in physiology, did so by working in the universities of the U.K.

Only during the last two to three decades has it been realised by our authorities that, both for proper training of medical students and for advancement of medical sciences, well trained physiologists are necessary. This realisation made some Indian universities institute postgraduate degrees in physiology for those working in medical colleges, while others instituted only special papers in physiology as a part of the postgraduate degree in medicine. No serious organised attempt was made to introduce postgraduate teaching programmes for those intending to go in for such degrees. This explains why the number of students, who obtained postgraduate degrees in physiology in India before Independence, was very small indeed.

In the wake of Independence, the number of medical institutions grew rapidly (the number at present being 80) and it was realised that there were not enough trained teachers and research workers to shoulder the teaching and research responsibility in physiology. There were not enough trained personnel available even for the physiology departments of the existing medical colleges at that time, and it has not been possible to train enough physiologists during this period to keep pace with the rapidly increasing number of the departments of physiology in the medical colleges. And although very serious attempts have been made by various universities to institute postgraduate degrees in physiology and to take up the training of

OPENING REMARKS BY THE CHAIRMAN

L. W. Chacko

FRIENDS, it may be asked: why another seminar closely following one on the same topic held a few months ago? We are all painfully aware of the backwardness of anatomy in India today, our continuing practice of anatomy as it was practised a hundred years ago in Europe, the unsatisfactory working conditions prevailing in our anatomy departments and the decreasing attraction for young medical men to take up anatomy. The discussion on all aspects of the problem will certainly take more seminars than one. The Indian Medical Council, which is concerned with incorporating remedial measures into the standards laid down for postgraduate training, did well to sponsor the last seminar. There is still much scope for fresh approach and continued thinking on the problem, further processing and clarification of half-baked ideas. Time and again we should meet to take stock of what we have achieved and where we stand now and what future directions we propose to take. The IAAME has given us yet another opportunity to give free expressions to any new ideas and suggestions, which had not been dealt with or were incompletely dealt with earlier, and to deal with the problems on hand as academic ones so as to eliminate bias as much as possible. Thanks to the Association.

Broadly speaking our problems cover three areas:

1. The striking advance modern anatomy has made in its area and content. One-third of anatomy deals with the historical aspect (not history of anatomy), genesis and growth of tissues and organs from germ cell and the evolutionary origin and development of man. The next one-third of anatomy has come into being on account of very high magnification attained in the optic instruments and other technological advances. The remaining one-third is gross anatomy; its clinical and basic values have by no means shrunk but an expanse grew from it far beyond its old limits.

2. The organisation of our departments should include the advancing frontier fields in anatomy. The working units under experts in special fields permit their rapid progress. As seen from our working papers, the non-medical experts are now generally recognised as suitable for certain branches of anatomy, such as genetics, cytology, histochemistry, developmental anatomy (experimental and comparative embryology), as medical men who take up these specialities are rare. The fields lagging far behind in India should be given some priority, e.g. electron microscopy, experimental embryology, etc.

3. Implementation of a well organized postgraduate programme.

Our final goal should be that at least the next generation of anatomists would not feel in their turn that they are still lagging behind in India and they should not point their finger at us to say that we have done very little in the 15-20 years after Independence to carry anatomy to an international level. May the deliberations of our meeting take us in the right directions.

It would thus be realised that the organisational pattern of postgraduate teaching programme io physiology in our country today needs to be orgaoised on a more firm and efficient basis. As the need for training a large number of physiologists for filling up the posts of senior teachers and research workers in the various medical institutions in the country is urgent, it is high time for the authorities and the universities to take a decisioo to plan and organise the pattern of postgraduate teaching programme in physiology so that a certain minimum course could be laid down for a definite period for turning out initially physiologists with broad-based knowledge who may later on go into research speciality. It is, therefore, suggested that, keeping this aim in view, the organisational pattern of postgraduate teaching programme in physiology may be worked out on the following lines. It may oot be out of place to mentioo that, in the deliberatioos of the recent seminar on postgraduate teachiog organised by the Medical Council of India, it was stressed that the postgraduate teaching programmes in physiology as well as in other subjects should have a uniform policy throughout all the Indian universities with regard to the nomenclature and designation of degrees awarded in the subject of physiology. The degree of M.D. should be awarded to medical graduates and that of M.Sc. be restricted to the non-medical graduates taking up physiology for their postgraduation. The degree of Ph.D. should only be given oo the basis of research, aod this should be open only to those who have already obtained a general broad-based training in physiology by going through the M.D. and M.Sc. courses.

It should be realised that, to become a good physiologist, one may have to put in a life-long study. The aim of postgraduate trainiog, therefore, is to let the postgraduate student attain a certain minimum level of koowledge in all the fields of physiology with some specialised knowledge in certain fields which are of direct ioterest to him. It is also realised that this minimum traioing cannot be imparted in less than a period of two years ond, therefore, every postgraduate student in physiology must spend at least two years of registratioo in o recognised department of physiology, having trained senior teachers.

During the period of registration, certain minimum courses of curriculum contents should be worked out and every postgraduate should be able to undergo these courses. The courses have to be worked out to impart both theoretical and practical training in the subject. Theoretical training could be mostly imparted through the means of seminars, in which the postgraduate student should be made to participate actively. The emphasis should be laid on the learning by the students rather than on formal lectures by the teachers. The practical course to be devised in any department would mostly depend upon the equipment and facilities available.

As most of the postgraduate students are going to work as teachers after obtaining their degree. it is essential that they should also be trained in teaching methods. This can be achieved best by associating them with the teaching and training of the undergraduate students.

These students after their postgraduation have to work both as teachers as well as research workers. It is, therefore, essential that a certain amount of training in research methods be imparted to them during their period of trainiog. This can be accomplished by giving them some research project on which they could submit a thesis. This will develop the faculties of planning of experiments, conduct of research studies, making observations and interpreting them properly, as well as learning the art of studyiog the literature and presenting their results

physiologists in their medical colleges, the number of medical graduates who have offered themselves for such a training has not been sufficient to provide for all the needs and requirements of the country. This also explains why it has not been possible to organise the postgraduate teaching programmes in physiology in different medical colleges and in the universities on proper lines.

At the present moment, almost all the Indian universities have instituted postgraduate degrees in physiology for medical graduates as well as for science graduates in the case of some universities wherein the physiology departments are attached to the medical colleges. As far as I know only Calcutta University has organised a regular course in their science faculty also, for awarding postgraduate degrees in physiology. In spite of the fact that most of the medical colleges, which have senior teachers working on their faculty, are registering students for postgraduation in physiology, the training of these postgraduates has not been taken up on a really organised pattern. This is mainly due to the fact that in the various medical colleges in the departments of basic medical sciences—including physiology—there are very few faculty members who already have had sufficient training in the subject, and who have to spend a very large part of their time in teaching and training the large number of undergraduate students who are being enrolled in these medical colleges. Therefore, the time which these members can devote to the training of the postgraduate students is very limited. If the postgraduate teaching programme in physiology in the country has to be put on proper lines, and if it is to be well planned, the course and curriculum have to be worked out realistically besides recruiting large numbers of trained personnel who can devote sufficient time both to the undergraduates and to the postgraduates.

In view of what has been said above, the postgraduate teaching in physiology at the moment is not well organised on a definite pattern. Different universities and different medical institutions in the country are following different patterns of training and examinations for postgraduate students in the subject of physiology. Some universities award the degree of M.D. in physiology, others have in M.D. in medicine the special subject of physiology, while others are still awarding the degree of M.Sc. in physiology both to medical and non-medical graduates. Still others allow medical graduates to enroll directly for Ph.D. The degree of Ph.D. is mostly awarded on the basis of a research thesis. On the other hand, the degree of M.Sc. is awarded by some universities on the basis of a research thesis, while other universities hold an examination for the same. The examination pattern for M.D. also differs to some extent in different universities.

The period of registration for postgraduate training leading to the award of postgraduate degrees is also different in different universities. Some universities allow a postgraduate student to register for a minimum period of six months to a year; others insist on a registration of two years or even more. Not only the compulsory period of registration for training but also the training methods differ from institution to institution. In some institutions the period of registration is mostly utilised for carrying out a research project and the writing of a thesis and the student is left to himself for learning the subject. On the other hand, at other centres, there are a number of organised courses—both theoretical and practical—which a postgraduate student in physiology has to undergo.

NON-AVAILABILITY OF ENOUGH POSTGRADUATE STUDENTS IN PHYSIOLOGY: REMEDIAL MEASURES

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THE number of medical colleges in receot years has registered a sharp rise. In 1951, the number was 30 with "a capacity" of 2,500: io 1963 this has gone up to 78 with an "intake capacity" of 7,000 per year. The Postgraduate Medical Education Assessment Committee estimated that there is a deficiency of 2,000 medical teachers io India. Aod if we take into account the further increase in the number of medical colleges and in the number of ndmissioos of students io the old and new colleges, the number will go still higher up. Naturally, many of the colleges—especially the new ooes which teach basic sciences—are finding it extremely difficult to man the various departments at the desired level. The purpose of this paper is to aoalyse what factors have led to the non-availability of enough postgraduate students in physiology and the measures that could be adopted to attract more postgraduate students in this discipline.

Throughout the couotry, for the last five years or so, the oumber of applicants for admission ioto medical courses has been dropping. Some of the medical colleges which restrict their admissions to State residents are now finding it difficult to get qualified applicants. Most of the colleges have been forced to lower their staodards somewhat.

One of the major factors for this diseochantment of the younger generation with medicine is of course economic. Pay scales for medical teachers are relatively low in comparison to those in other careers. Therefore, the salary ceilings for teachers and scientific personnel of the medical services should be raised to make them competitive with other services. At least the following scales of pay recommended by the Health Survey and Planniog Committee for the teachers of the undergraduate and postgraduate medical colleges should be immediately implemented:

		Uodergraduate College	Postgraduate College
		Rs.	*Rs.*
Professor	...	1500-2500	2000-3000
Associate Professors	...	1250-2000	1500-2500
Readers	...	1000-1500	
Lecturers	...	600-1000	
Demonstrators/Tutors	...	350-600	

It may also be useful to institute an Indian Medical Education Service to bring it at par with other services, such as I.A.S., I.J.S.. I.E.S.

cogently. Such a training should enable them to take up research studies in their later career, even while they have to devote a good bit of their time to teaching.

It is realised that a time has reached when we should take up the training of large numbers of postgraduates in physiology on proper lines, as the postgraduates of today are going to be the teachers and research workers of the country for a long time to come and the future training of physiologists is going to be in their hands for a long time. It is high time therefore that we seriously considered the organisational pattern of postgraduate teaching programme in physiology. The success of our future endeavours will be determined to a great extent in terms of the planning of today. I hope the holding of the present Teaching Institute of Postgraduate Medical Education under the auspices of the *Association for the Advancement* of Medical Education will go a long way in recognising the need for training more postgraduates and in working out the details for organising such a training in the future.

The medical graduates prefer to go for postgraduation in clinical subjects in which, along with enjoying a better status and prestige in society, they have an additional scope for private practice. This opinion is supported by the views of senior medical students. The data reveal that a low income is the most important factor in influencing the medical student against a career of teaching and research in the basic sciences. Naturally, therefore, this career would be more attractive should it provide an income commensurate with that available in the clinical fields. This can be remedied easily by having full-time clinical teaching units with uniform pay scales for both clinical and basic science teachers. And this will have two advantages:

(i) When the charm of private practice is lost in the clinical appointments, more medical graduates will opt for postgraduation in basic sciences.
(ii) The teachers of the clinical sciences will get more time to devote to research and teaching.

Recently, the Indian Council of Medical Research, Government of India, and certain State Governments have started providing fellowship to the students doing postgraduation in clinical subjects on much the same terms and in the same way as to candidates doing postgraduation in basic sciences. This would, no doubt, improve the competitive position of the postgraduate students in clinical sciences, but it might further reduce the number of postgraduate candidates in physiology and other basic sciences. I suggest that intelligent and promising students, who offer to take up physiology, should be given a fellowship of at least Rs. 100.00 per month during their undergraduate course. Similarly, all the students who are admitted to the postgraduate course in physiology should be given a monthly stipend of Rs. 300.00 for the duration of the course.

A second factor of importance is the relatively low social prestige or status of the teacher in the community. This is in sharp contrast to his European counterpart who, though he may enjoy no greater economic advantages, enjoys at least a high prestige in society. Such an attitude is partly economic in origin, for in our society materialistic comforts, such as car, club membership, etc., influence greatly the thinking of our youth in the choice of a career. But prestige or the absence of it has more than materialistic implications. Were this all, the problem would not be so serious. Ingrained in the public mind is the adage: "He who can, does; he who can't teaches." Professor is almost a term of derision. The able and forward-looking teacher in a medical college looks towards full-time research or high level administration. Promotion is always to less teaching, not to more. The prestige of a teacher should therefore be restored in the academic world and heightened in the eyes of the general public. The postgraduate training should not be all course-work and thesis. It should be a training for a full-fledged academic career and hence it should include some teaching experience. In this way we can develop in the minds of the coming generation a realistic attitude toward the two elements of an academic career, namely research and teaching. My suggestion is somewhat akin to that of the father who cautioned his son: "Don't marry for money. Go where the money is and marry for love."

Committee for the undergraduate and postgraduate medical colleges.

4. Graduates in science and allied subjects should be encouraged to take up postgraduation in physiology after adequate comprehensive training.
5. B.Sc. (Med.) should be instituted which will form an important source of postgraduate students for physiology.
6. The career opportunities in physiology should be publicised. The postgraduate students should be recruited with the same vigour as personnel in an industry.
7. The small and new medical colleges should be given necessary facilities so that the qualified staff could undertake research and limited postgraduate teaching.

consideration must be given to teaching ability. Furthermore, I decry the developing practice of a University Society with two classes of citizens; the research *elite* and the teaching proletariat.

It has been difficult to recruit junior teachers for new colleges as the departments are not recognised for postgraduation. The University of Rajasthan have permitted the qualified teachers of these colleges to take postgraduate students in the branches in which research facility exists in collaboration with the postgraduate teachers of the recognised postgraduate departments till the departments of these new colleges are fully recognised for postgraduation. The postgraduate students working in these colleges have to attend a comprehensive 4-month training programme organised at the recognised postgraduate departments.

In some of the institutions the candidates doing postgraduation in clinical subjects are appointed to junior posts like demonstrators and lecturers, while in others graduates and postgraduates in allied science subjects like zoology, chemistry, etc. are appointed to these posts. One consequence of these two schemes is that when a position cannot be filled with a candidate of calibre, the institution lowers its sights and appoints someone of less than optimal ability and training or a person not interested in the subject. This deterioration of quality poses an even greater threat to education than does the insufficient number of teachers. The question whether non-medical graduate should be encouraged to take up postgraduation in physiology has assumed importance in view of the shortage of teachers. Our Association could profitably make a penetrating study of how it can utilise the non-medical graduate. The University of Rajasthan has permitted the postgradnates in allied sciences like zoology to do postgraduation in physiology after a candidate has undergone a three years' training programme. The University has also instituted a two years' course of B.Sc. (Med.) in anatomy, physiology and biochemistry for students who have passed I.Sc. or 1st year T.D.C. It is hoped that these B.Sc. (Med.) students will form an important source of postgraduate students for physiology and allied sciences.

Finally, I also think that the lack of understanding or appreciation of the potentialities of physiology contributes in no small measure to the failure to attract students interested in postgraduation. At the college level, good students as well as the science teachers should be acquainted with the opportunities available for postgraduate study in the fields of medical science. The students should get not only the concepts of a classical course, but also the idea that it is a growing subject. In the prospectus describing programmes of postgraduate study in the basic sciences, it is suggested that there should be a brochure outlining the opportunities and advantages of a career in the basic sciences, with particular reference to teaching and research.

The remedial measures can be summarised as follows:

1. Suitable candidates who offer to take up physiology as career should be given a fellowship of Rs. 100.00 per month during the undergraduate course.
2. The medical or science graduates taking up physiology for postgraduation should be given a stipend of Rs. 300.00 per month during the training period.
3. The economic status of medical teachers as a whole should be improved at least by adopting the minimum scales of pay recommended by the Health Survey and Planning

devote sufficient time to the training of the postgraduates. It is also necessary that the help of a senior biochemist and a biophysicist be available to them.

FUNCTIONS OF THE POSTGRADUATE DEPARTMENT OF PHYSIOLOGY

Broadly speaking, the main functioos of the postgraduate department of physiology are as follows:

(1) To train and produce teachers in physiology.
(2) To train and produce research workers in physiology.
(3) To give postgraduate training in physiology to those clinicians who are interested in widening the horizons of their knowledge regardiog the physiological basis of disease.

With these aims in view, the training programme of the postgraduate departmeots of physiology has naturally to be broad-based.

Each postgraduate student requires inteosive training io research techoiques apart from a regular course of advanced laboratory experiments. It is also desirable that due stress be laid on applied physiology in such training programmes. A research thesis should form a compulsory part of the postgraduate examination in physiology.

RELATION OF POSTGRADUATE DEPARTMENT OF PHYSIOLOGY TO THE DEPARTMENTS OF ANATOMY, BIOCHEMISTRY AND BIOPHYSICS

The history of medicine bears out the fact that growth of koowledge io the basic disciplines led to the separatioo of anatomy, physiology, biochemistry and biophysics. Though such a separation has helped tremendously io the development of these disciplines, it would be erroneous to assume that these disciplines can thrive io isolation. For proper training of a postgraduate student in physiology, a proper understanding of the biochemical and biophysical principles is absolutely essential. In fact, at the research level, physiology, biochemistry and biophysics are closely interdependent. In an institution imparting postgraduate training in physiology, well developed departments of biochemistry and biophysics are, therefore, essential. What is more important is that the senior teachers of the departments of physiology, biochemistry and biophysics should have a spirit of comradeship and they should combine their efforts and develop an integrated programme of practical training for the postgraduate students. A well developed department of anatomy with the co-operation of senior teachers can be a great help to a postgraduate student of physiology, specially in the fields of neurology and embryology.

STRUCTURE AND FUNCTION OF THE POSTGRADUATE DEPARTMENT OF PHYSIOLOGY AND ITS RELATION TO THE DEPARTMENTS OF ANATOMY, BIOCHEMISTRY AND BIOPHYSICS

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TILL a few years back, postgraduate teaching in physiology could hardly be considered to be well organised in most of the medical colleges in the country. Some universities were conducting regular postgraduate courses in physiology leading to M.Sc. and Ph.D. degrees, under the auspices of the science faculty. A number of patterns were prevalent in medical colleges in respect of the postgraduate studies in physiology. A large number of medical colleges were awarding M.D. degrees in medicine with physiology as a special paper in the examination. In this pattern, a full examination in the subject of medicine had to be taken by the candidates. The result was that the M.D. degree with physiology as speciality was a rather terse examination for the candidates primarily interested in physiology. In recent years, however, most of the medical colleges and universities having medical faculties have realised the great importance of trained postgraduates in the subject of physiology and have, therefore, cut down the examination in general medicine for candidates taking M.D. degree in physiology. Here, the entire examination pertains to physiology, biochemistry and biophysics. Some medical colleges have been running courses leading to M.Sc. in physiology.

STRUCTURE OF POSTGRADUATE DEPARTMENT OF PHYSIOLOGY

In most of the medical colleges, where postgraduate training in physiology is being imparted, the structure of the department has been primarily suited to undergraduate training and no planned organisation for postgraduate training has generally been undertaken. The candidates are mostly left to their own resources and there is hardly any uniform pattern of basic practical training. Apart from special institutes like All-India Institute of Medical Sciences, the majority of the departments of physiology in medical colleges in this country are suffering from paucity of trained teachers. In most of the colleges, the teacher-student ratio, even with respect to undergraduate students, is not very satisfactory. The result is that the few senior trained teachers in the department are so overburdened with the routine teaching programmes of the undergraduate that a well organised intensive training programme for the postgraduate students is hardly possible. Usually, the postgraduates are left to themselves and, therefore, receive scanty guidance and meagre practical training. It is necessary, therefore, that in the interest of postgraduate teaching in physiology, the staff pattern of the department of physiology in the medical colleges should be so organised that at least two senior trained teachers are able to

and, therefore, it is hard for a postgraduate student of physiology to keep himself abreast of everything. This is true, but then we must admit that physiology is not meant for the mediocre. If we want to raise our medicine to the levels it has reached in the U.S.A. and the U.S.S.R., we will have to bring our teaching and study of physiology to the position that it occupies in those countries. Men of first class calibre join medical colleges in our country, but, unfortunately, only with an eye to the loaves and fishes. We have to try all our resources to wean some of these to a career of physiologists. This could perhaps be done by dovetailing the undergraduate medical course and postgraduate training in physiology. Why can the postgraduate training not be initiated soon after the first M.B.B.S.? The hurdle of too much knowledge can be overcome by feeding material that is easily palatable to a system that has excellent digestive powers. Young students can show great avidity at possessing knowledge and learning techniques. We should start these meals early enough.

The curriculum in physiology has, in addition to ensuring possession of reasonable amount of knowledge, to include measures to cultivate a creative mind. No world-shaking discoveries can ever be expected from all those students who study physiology, but attempts have to be made to see that freshness of outlook is maintained and the mind remains constantly exercised by intellectual problems. Provision of a certain amount of compulsory research in the curriculum can help to achieve this.

The pure research type of training can produce excellent physiologists but more often than not they may find it difficult to teach the various topics in physiology even to the undergraduate students. Pure research should, therefore, be introduced at a later stage. The suggested practicable curriculum for postgraduate physiology can be best illustrated by following a programme of study and assessment of training stated below.

A. *Training*

(*a*) The candidates should spend 3 years after M.B.B.S.: 6 months in clinical medicine or surgery and 2½ years in a good department of physiology. Where facilities are considered inadequate, one year out of 2½ years should be spent in a department specially accepted for postgraduate training. It is needless and hard to expect a student to spend two or three years in a place other than his own. At the same time it is not proper to keep him wholly in a place where facilities are not well developed.

(*b*) During the course of training, he should be required to follow some simple topic for a longitudinal study over a period of 12 months or so at the end of which he should be guided to write a thesis. This would enable him to get familiar with methods of investigation, study of literature and methods of evaluation and presentation of data.

(*c*) He should be required to carry out common experiments in amphibian, mammalian and human physiology and simple studies in biochemistry and biophysics. These should be recorded in a well maintained laboratory book.

(*d*) Series of didactic lectures and seminars should be held in which he should be asked to participate actively.

(e) He should also be encouraged to read widely both physiology and related sciences. A good deal of guidance is necessary in library work in a subject like physiology.

AIMS AND CONTENT OF THE POSTGRADUATE PHYSIOLOGY CURRICULUM

T. H. RINDANI

THE evolution of training in physiology in this country has suffered because it could not integrate the English and the American patterns which it had tried to emulate. One of the results of this has been a state of confusion in the aims and content of the curriculum in this important basic medical science.

Before the medical education in this country discovered itself, physiology was regarded as just an incident that occurred in the training of a medical student. Except perhaps in the Calcutta University, it did not have the status of a branch of science. Postgraduate training in physiology almost did not exist and perhaps it was not even thought of.

The current increasing consciousness amongst us regarding the urgency to reform medical education found its expression in the appointment of the Bhore Committee, and the remarkable progress that the committee made in the wake of Independence, by increasing contacts with the medical educationists of the world through international agencies like the W. H. O. and the Rockefeller Foundation, brought us to the realisation that the study of medicine could not neglect basic medical sciences. The first few physicians who allowed themselves to be induced into physiology are now realising the benefits of seeing and knowing what physiology means to medicine. Now, physiology is getting some attention and it is being realised that both for proper training of medical students and for advancement of medical sciences, well trained physiologists are necessary. The good old days are gone when physiology could be taught by a general practitioner who could spare a couple of hours from his practice and talk to students out of a book on physiology which he could read in leisure hours. We need properly trained physiologists to teach the subject and to contribute to its advancement.

The aims, therefore, of postgraduate training in physiology are clear:

(a) Thorough knowledge of physiology along with its related sciences on a comprehensive basis;
(b) good acquaintance with how this knowledge has developed over centuries;
(c) familiarity with recent advances in physiology;
(d) building up a perspective in physiology;
(e) familiarity with techniques utilised in the study of physiological phenomena; and
(f) application of physiological principles to medicine.

(*f*) Ability to read at least one foreign language, preferably Russian, other than English should he expected in view of the tremendous advances in physiology in that country.

(*g*) While histological techniques need not be mastered, thorough familiarity with minute structure and its relation to function for all tissues must be obtained.

At the end, an examination should be held if the thesis is found to be satisfactory by the guiding teacher.

The hourwise distribution of the curriculum may be as under:

General Medicine/Surgery: 6 months resident post in a teaching hospital.

Section		*Hours* *Theory*	*Practical*
General Physiology		35	
Cellular Physiology		15	
Comparative Physiology		75	
Mammalian Physiology		300	
Applied Physiology		100	
History of Physiology		25	1800
Biochemistry		150	
Biophysics		35	
Nutrition		15	
	Total ...	750	1800

B. The examination should be on the lines indicated below:

(*a*) 4 papers of 3-hour duration each, covering: Fundamentals of Physiology. Mammalian and Medical Physiology. Biochemistry, Biophysics and Nutrition. Essay, containing History of Physiology.

(*b*) Practical examination:
4 practicals, of 3-hour duration each, extending over at least two days:
Experimental Physiology I: Amphibian Experimental Physiology II: Mammalian, Histology, Clinical & Human, Biochemistry & Biophysics.

(*c*) *Viva voce:* The degree of Doctor of Medicine (Human Physiology) should be given at the end of the successful completion of a *viva voce*.

Further studies, now on a circumscribed topic in physiology, could be taken in the form of research for at least two years and, on successfully writing a thesis, the degree of Doctor of Philosophy should be awarded.

BASIC AND SPECIFIC REQUIREMENTS OF A POSTGRADUATE STUDENT IN PHYSIOLOGY AND THE PLACE OF NON-MEDICAL GRADUATES IN POSTGRADUATE EDUCATION IN PHYSIOLOGY

DR. I. D. SINGH

TODAY the physiologist is playing a varied role in the Health Services of our country. He is not only required as a teacher in medical institutions, as it is the practice today, but is also needed as a teacher in dental, pharmacy and physical education institutions and as a research worker for the specialised problems connected with high altitude, nutrition, reproduction, ergonomics, neuro-physiology, etc. in the various national laboratories.

To fulfil the role as teachers, such specialists must be well up in their academic background and should be deeply interested in their subject so that they enthuse their students. An important requirement of such teachers is that, in addition to their knowledge of the subject, they should be passionately involved in research so as to keep alive their burning interests in the speciality and instil a spirit of enquiry in their pupils. It is incumbent, therefore, that medical graduates who have to become future physiologists fulfil certain basic requirements. However, as the present conditions in the country are, this speciality is attracting mostly mediocre medical graduates who join it not because they are genuinely interested in the subject but simply because they cannot be absorbed in more attractive spheres. This is perhaps one of the major reasons for a low standard of this speciality in our country as compared to some of the advanced countries where physiology has made tremendous strides and is continuing to do so everyday.

As a result of the great discrepancy between the ideal requirements and those which are practically feasible at present, we have, therefore, to strike a compromise in laying down certain minimum basic academic standards for the medical graduates to be admitted for training as postgraduate students in physiology. In my opinion these should be as follows:

A. *Essential qualifications*

(i) A medical graduate who passed the subject of physiology in the first attempt and did not make more than two attempts in qualifying for the M.B.B.S. degree. However, if the candidate is also B.Sc. (first class), the condition of passing physiology in the first attempt may be relaxed, but he should not have taken the examination more than two times (including that for physiology, if any) to qualify for the M.B.B.S. degree.

(ii) A resident appointment for one year (preferably of the rotatory type). Such a student will have better grasp of applied aspects.

B. *Preferential qualifications* (in order of preference)

(i) An ideal choice will be a medical graduate who, before joining first year M.B.B.S., has obtained a degree of B.Sc. in physiology, anatomy and biochemistry (of the type existing in Medical College, Amritsar, affiliated to the Punjab University).

(ii) An M.B.B.S. who has distinction/honours in physiology.

(iii) An M.B.B.S. without any extra attempts.

(iv) A candidate who has to his credit some research work in physiology or in some allied subject.

(v) An M.B.B.S. who before joining the M.B.B.S. course has passed B.Sc. (3 years' Honours School as per Punjab University pattern) in chemistry/botany/zoology, or B.Sc. in any of the following combinations—chemistry, zoology, botany or physics.

A cursory assessment of the present situation in our country will reveal that there is an extreme shortage of trained physiologists. In most of the State-run medical colleges, nearly half the sanctioned jobs remain unfilled for most of the time. It is also quite a problem to find trained physiologists to man jobs in other spheres. In future, the requirements for this speciality may probably increase considerably.

One very important cause of this scarcity is that, in the present set-up, physiologists as teachers *are all required to be medical graduates*. It is a common experience that a vast majority of medical graduates take up clinical work for their vocation because it is more rewarding. Consequently, very few take up basic medical sciences (including physiology) for their careers. The time, therefore, has come to think boldly about the difficult problem of shortage of physiologists in the midst of the general scarcity of doctors in this country. In my opinion, a very important step in this direction would be to devise measures to train certain non-medical personnel in this speciality and to give them an opportunity to reinforce the medical physiologists.

The problem of engaging non-medical physiologists as teachers in medical colleges is, of course, a highly debatable one, because the chief aim of medical institutions at present is to produce "basic" doctors. The most important argument against this class is that, since they have no medical bias, they should not be employed to teach undergraduate medical students. This is basically true, but, on the other hand, as already pointed out, we are at present in a precarious position as far as the present availability of trained physiologists in our country goes Therefore, I feel strongly that, despite this obvious objection, there is just no other way out but to try them, a procedure which has worked quite successfully in other advanced countries. In addition, there is a positive point in their favour as some amongst them may add to the standard of fundamental physiological research because of their better scientific background compared to most of the mediocre medical graduates.

Having accepted the principle, that time has come for the non-medicos to be trained as physiologists to play their role in this speciality, some measures may have to be devised to give such future specialists some sort of a medical bias. I believe that this can be done with reasonable success by organising a "special" course of one year for suitable non-medical

personnel before they are admitted to the postgraduate training in this speciality.

It will be out of place to go into the details of such a course. But I should like to mention that it would introduce the students to selected experimental methods and fundamental principles associated with the subjects of physiology, biochemistry, pharmacology and pathology. Some aspects of anatomy (both macroscopic and microscopic) may also be introduced along with elementary statistics. The course would be run jointly by several departments at selected centres where proper facilities exist, but there must also be a permanent skeleton staff meant for this purpose alone. Studies will centre around the functional and morphological characteristics of cell, organs, organ systems and the whole animal, and each topic selected for study would be approached from the various points of view represented by the different sciences. The course would be highly selective and limited in scope, that is to say, it would not cover all the topics in the conventional manner. The laboratory work should be organised in such a manner as to allow facilities for experimentation with varied techniques for experimental and research work.

In order to ensure that the teaching of applied physiology to the undergraduate medical students does not suffer, the organisation of the department of physiology should be such that the head of the department must be a medical physiologist and that the latter specialists will also contribute to at least 50 per cent of the strength of the rest of the teaching staff.

Assuming that non-medical physiologists will be acceptable in medical and other institutions, I suggest the following basic and specific requirements for such category of personnel.

ESSENTIAL QUALIFICATIONS

All the candidates must have passed a "special" course of one year to be instituted in certain medical institutions which can offer proper facilities. The admission to this course will be open to the following categories of qualifications in order of preference:

(*i*) Candidates who have passed 1st professional M.B.B.S./B.Sc. in physiology, anatomy and biochemistry.

(*ii*) B.Sc. (Second Division) with chemistry, botany and zoology as compulsory subjects.

(*iii*) B.Sc. (Honours School) in chemistry/zoology/botany, subject to the condition that the candidate has also passed intermediate with medical group.

(*iv*) B. Pharm. (Part I), subject to the condition that the candidate has passed intermediate with medical group or diploma in pharmacy.

(*v*) B.D.S. (Part I).

(*vi*) B. V. Sc. (Part I).

(*vii*) B.P.E. (3 years' degree course), subject to the condition that the candidate has passed intermediate with medical group.

It could be argued that the group selected to undergo the "special" course for future training in this speciality is drawn from rather heterogenous sources. However, in favour of this procedure may be cited a point that the very heterogenous elements composing this course may

perhaps enrich the level of mutual discussions which should form an important part of both the theoretical and practical aspects of this course. In any case, the worth of such a procedure can only be gauged by actual experimentation, and the future line of action can only be determined by observing the results thereof.

To attract a reasonable type of talent to this speciality, conditions will have to be created to see that these personnel when fully trained can be offered jobs of a similar position as they would have otherwise gained, had they chosen some other subjects for their speciality. For example, they could be treated at par with medical physiologists except in the matter of non-practising allowance. In matters of promotion, the suitable amongst them could reach the status of associate professorship at the top of their careers. Grant of other facilities like maintenance allowances, etc. for the duration of the courses will be highly desirable.

With this background and training, I believe, we shall be able to produce more trained physiologists to satisfy the needs of our country.

POSTGRADUATE TRAINING IN PHYSIOLOGY

DR. S. R. KAPOOR

OUR country needs a large number of physiologists to man the teaching and research institutions. The number of medical colleges is increasing and there is a great shortage of well trained staff in physiology. There are institutions where several posts have been lying vacant for the last so many years and there are only one or two persons to look after the whole training programme. Medical graduates are not inclined to opt for this speciality as they find it less remunerative and less honourable as compared to medicine and surgery. Unless adequate measures are taken soon to remove this disparity between the clinical and non-clinical departments, no training programme in physiology is going to be successful, as the quality and quantity of the candidates coming forth for such a programme will be poor. Huge palatial buildings and costly equipments are of only secondary importance. What we need are well qualified teachers and enthusiastic and intelligent postgraduate students.

However, presuming that they will be forthcoming, I give below an outline of a postgraduate training programme in physiology which, I hope, my colleagues will approve.

Aims and Objects of Postgraduate Training in Physiology

(*a*) To produce teachers for educational institutions.
(*b*) To produce investigators for research institutions.

Scope of Training

The scope should not only include a study of human physiology in relation to the clinical sciences but also cover diverse ancillary subjects, e.g. comparative physiology, biophysics, biochemistry, genetics, statistics and psychology.

Type of Training

The training should be conducted in two stages. In the first stage, the training should be broad-based and should lead to the first postgraduate degree in the subject. In the second, an intensive training should be given in any of the fields covered in the first stage with emphasis on advanced research.

Postgraduate Degrees which should be Instituted in Physiology

(*a*) First postgraduate degree to be M.D. (Physiology).
(*b*) Second postgraduate degree to be Ph.D. (Physiology).

Prerequisites for Postgraduate Training

(1) M.B.B.S. degree recognised by Indian Medical Council.
(2) House job or internship for one year in a recognised hospital.

Period of Training

Two years for M.D. and 2 years after M.D. for Ph.D. It would be esseotial for the candidate to remain in the department of pbysiology recognised for imparting postgraduate training.

Curriculum for Postgraduate Degree (M.D.)

It should be a brief course coosisting of studies in

I History of physiology
II Comparative Physiology
III Biophysics
IV Biochemistry
V Histology
VI Statistics
VII Psychology
VIII Genetics

It should include a comprehensive course of study, basic as well as applied, in the following:

I Cardio-vascular physiology
II Respiratory physiology
III Neuro-physiology and special senses
IV Physiology of excretory system
V Physiology of gastro-iotestinal system
VI Physiology of eodocrioe and reproductive system
VII Nutrition aod metabolism

The trainiog programme sbould ceotre round:

Lectures on the latest advances in each system.
Demoostratioo of different experiments involving the use of the latest techniques.
Practicals in biochemistry, histology, mammalian and human physiology.
Seminars on special topics. Symposia on recent problems of research.

The details of this programme should be worked out by the department concerned.

Method of Assessment of Postgraduate Degree (M.D.)

There should be an examination conducted in two parts. Part I may be taken at the end of the first year.

(1) Theoretical examination consisting of 4 papers
I. Paper on topics marked I to VII above
II. Paper on topics marked I to VII above (systemic)

III. Latest advances
IV. Applied physiology

(2) Practical examination in

I. Biochemistry
II. Histology
III. Mammalian physiology

(3) Oral examination

Part II examination should be held one year after the candidate has passed the first part. It will consist of a thesis to be examined by the three examiners of which two must be external.

Second Postgraduate Degree

May be called Ph D. which should be conferred purely on the basis of advanced research. The candidate should have obtained M.D. (Physiology) or should have been a teacher in physiology for at least ten years in a recognised medical college.

Training in Advanced Physiology for Medical Specialities

The training should be imparted by physiologists for postgraduates in medicine, surgery, ophthalmology, obstetrics and gynaecology, paediatrics, tuberculosis and orthopaedics in consultation with the specialities concerned.

Minimal Requirement in Equipment and Personnel

The department imparting postgraduate training in physiology must have the essential equipment pertaining to the different fields of the subject. Electronic gadgets like E.C.G., E.E.G., oscilloscopes and electronic recorders, stimulators, stereotaxic instrument, spectro-photometer, photo-electric colorimeter, flame photometer, etc. must be available in the department. Facilities for photography, workshop for designing, improvising and constructing tools for research are essential.

Adequate library facilities must be available to the candidate. The department should have sufficiently qualified teachers in adequate numbers. Teachers should be whole-time teachers and non-practising type who should necessarily be paid higher salaries as compensation for the loss of private practice.

No department should be allowed to start postgraduate training in physiology unless it is inspected and approved by the Indian Medical Council.

Period of Training

Two years for M.D. and 2 years after M.D. for Ph.D. It would be essential for the candidate to remain in the department of physiology recognised for imparting postgraduate training.

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V Physiology of gastro-intestinal system
VI Physiology of endocrine and reproductive system
VII Nutrition and metabolism

The training programme should centre round:

Lectures on the latest advances in each system.
Demonstration of different experiments involving the use of the latest techniques.
Practicals in biochemistry, histology, mammalian and human physiology.
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  II. Paper on topics marked I to VII above (systemic)

practice in many places. In most faculties the usual practice is to present the thesis at the end of the first year, the candidate appearing in the examination at the end of the second year. This has the following defects:

(a) One year is too short a period in which to select a problem, get acquainted with the literature in the field, become proficient in the methods, and obtain sufficient results to form an opinion.

(b) The candidate leaves the research problems and takes to preparation for the examination, thereby losing touch with the problem which he does not take up again.

In a few faculties, the examination is held at the end of the first year and the thesis is submitted at the end of the second year. This has the disadvantage in that the period of training in the main subject and allied fields of study is not sufficient.

In order to get over these difficulties, it is suggested that the work in connection with the problem, for the thesis and the course of training must go hand in hand. The thesis can be presented about three months earlier than the examination, so that assessment can be made at the time of the examination.

EXAMINATION

Written: Four papers, each of three hours' duration.

I—General Physiology
II—Biophysics and Biochemistry
III—Human Physiology
IV—Applied Physiology

Practical: There will be four practicals, each of two hours' duration.

I—Experimental Physiology I
II—Experimental Physiology II
III—Histology
IV—Biochemistry

Experimental Physiology (I) would be mostly on mammals and would include *in situ* and isolated organ experiments, like those of recording heart beat, blood pressure, secretion of digestive juices, urine excretion, intestinal movements, etc. and their experimental variations. They may also include experiments on sub-mammalian species.

Experimental Physiology (II) would be human experiments like lung function tests, determination of metabolic rates and energy expenditure, blood gas analysis, air analysis, muscular efficiency tests, etc.

Histology practical would include preparation of sections and their staining including the use of special methods of histochemistry for demonstration of glycogen, etc.

Biochemistry practical would include determination of composition of blood or plasma or urine constituents, identification of substances in body fluids and preparation of the more common varieties of substances of physiological importance.

EXAMINATION AND ASSESSMENT OF POSTGRADUATE STUDENTS IN PHYSIOLOGY

PROF. C. M. FRANCIS

THE examinations in physiology will depend on the objectives of training which for purposes of discussion are assumed as:

(1) Training for teachers in physiology for medical and non-medical courses of study.
(2) Training for research workers at different levels in physiology.

These programmes are expected to be complementary, as far as possible, and not mutually exclusive.

These training programmes can be achieved by courses leading to the M.D., M.Sc., and Ph.D. degrees in physiology in the medical faculty.

M.D. The degree is meant for medical teachers. It is necessary that the candidates should have an overall knowledge and competence in physiology and in allied fields. They should have a strong medical bias and a very good knowledge of the applied aspects of the subject. It is also necessary to train the candidate in such a way that he will be able to probe in depth in any field he may wish to take, collect all relevant literature, critically analyse the results and evaluate them.

M Sc. This will be for candidates who teach physiology in non-medical courses of study and also for those who want to take up research positions in institutions, including medical colleges, as scientific assistants, research officers, etc. It will be necessary to have a definite research orientation.

Ph.D. This will be for those who are desirous of, and are suitable for, taking up better type of research work. Their training will be such that they can become top teachers and research workers The emphasis will be on research.

Examination: M.D. In order to assess whether the candidate is proficient generally in the subject and allied fields and to ensure a proper emphasis on applied aspects, the examination will consist of written, practical and viva voce. Among the requirements will also be a thesis to assess the proficiency of the candidate in properly collecting all relevant literature in the field and evaluating them. It will help him to know the different types of approaches tackling a problem and will make him familiar with handling instruments and appliances. The candidate should do a considerable amount of work on his own (though supervised) and he must be able to explain cogently his own findings and results and arrive at proper conclusions.

The training programme and work on the specific problem must go on simultaneously and the thesis must be evaluated at the time of the examination itself. This is different from the current

Viva voce The oral examination will consist of two parts. The first part of viva voce will be exhaustive so as to give adequate coverage of the subject and allied fields. The second part will be oriented towards the special field of study of the candidate and his thesis.

M.Sc. The requirements for M.Sc. will be similar to those for M.D. with some variations in detail. In the written examination, instead of a paper on applied physiology, there will be a paper on comparative physiology. The scope for human experiments will be very much reduced but the scope for mammalian and submammalian experiment will be increased consequently; the practical tests will have to be modified to that extent.

Ph.D. The requirements will be a thesis followed by a viva voce. There will be no other examination including the preliminary examinations in methodology or other basic sciences. This is somewhat against the current trend in the country. The aim being to produce first class researchers, it is best to give a wide latitude to the candidate (under supervision) to determine how best to tackle the problem. All other efforts will detract from this.

Assessment. In assessing candidates for M.D. or M.Sc. examinations, it is necessary to form an overall opinion of the candidate rather than of each part. This can be done best by a system of grading like A = Good, B = Satisfactory, C = Unsatisfactory. If a candidate gets "C" in more than one of the papers, practicals and Oral I put together, he will be deemed to have failed; otherwise a "C" can be set off against an "A." The candidate must get an average of "B" or above separately in written, practical and Oral I in order to pass. The examiners will be three in number and two of them, at least, must be from outside the university. All examiners shall examine each candidate in written, practical and oral examinations.

The thesis will also be judged by these examiners and they will report as "highly commended," "commended" and "not commended," taking into consideration the performance of the candidate in Oral II. If the thesis is not "commended," the person may be allowed to resubmit the thesis at the end of a period of 6 months or 1 year as decided by the Board of Examiners. If the candidate fails in the examination, then he may appear again for the examination at the end of 6 months. If he fails in the examination and his thesis is also not approved then he can resubmit his thesis and reappear for the examination only at the end of a year. No candidate will be allowed more than three chances.

Ph.D. The assessment will be made by a panel of two judges for the thesis. A viva voce will be held, if necessary, and this will be to support or defend the thesis. The panel of judges shall be men who are highly proficient in the respective fields and should consist of persons outside the university to which the candidate belongs. There should be evidence of sufficient original work and results in the thesis for it to be approved. If the judges do not approve of the thesis, the candidate may be allowed to resubmit the thesis at the end of the next year.

It bas already been poioted out that a knowledge of practical methodology and of recent advances in the subject is a prerequisite for researcb traioing. Io a postgraduate course, rigbtly, a major portion of time should be devoted towards the same. Intensive practical training and extensive study of tbe subject witb appropriate stress on the original observations will condition the student to research training. Encouragement of group discussions on specific topics presented by one of the subjeets will lay tbe fouodatioo for future researcb training.

Research training implies specialisation of a branch of a subject; but in postgraduate courses it is intended only to infuse in the student, through his participation, the spirit of the individuals whose personal eontributions resolted io the present-day knowledge of the subject. Researcb training can be broadly categorised into four heads: 1. Collection of literature and objective analysis. 2. Planning of experiments and observation of results. 3. Interpretation of observations. 4. Objeetive presentation of tbe ohservatioos.

Equal stress sbould be laid on all the four aspects during the award of training and evaluation. Repetition involving increase in the volume of work should be discouraged. This is possible only by giving greater importance to the quality than to the quantity of work in evaluation.

On the completion of the advanced study, a student sbould be nssigned a problem which should take into account any special interests developed by him during his training period. He sbould be advised to devote his time in the beginning equally between the collection of literature and the learning of dexterous use of apparatus and special techniques. During this period too, by following his daily progress and by helpful suggestion and discussion, the student should be made to compreheod a problem and evolve n plan of wprk. Dependenee on tbe teacher sbould be discouraged and at no stage should ready-made nnswers be given; rather, by means of queries, and further reading, he should be asked to solve problems. With the passage of time, tbe student gains confidenee and becomes self-reliant. This is the purpose of postgraduate edueation.

Thesis writing is an essential part of postgraduate research training. It is a practical exercise for the student in colleetioo and presentation of observations, which nims at a definite objeetive. It also presents an incentive to tbe student for extensive collection of literature. It is easier to form ao idea from a study tban giving it concrete sbape in writing. The way literature and observations are presented iodicates the mode of thinking of the student. Actually, the objective of research training is to inculcate a method of thinking in the student. In this respect, a thesis provides tbe best way for the evaluation of researcb training. In some universities, where dissertation work takes the place of researeh training, a student eollects literature on a specific topic and simply presents the materials. The student does not do any new work. Deep study necessary for presentatioo of literature brings the studeot nearer to the subject and this increases his appreeiation of the subject as also the thought process. Research training in postgraduate courses is a step forward in bringing the subject closer to the students. Here, thesis takes the place of dissertatioo. Research training is just like any other practical training. A judgment cannot be passed oo the potentialities of a musician or an artist by written or oral examinatioo alone. He can be judged only on the basis of his actual performance. Similarly, evaluatioo of the thesis only gives the best judgment of the students' potentialities for researcb, whicb cao he supplemented by oral examination.

Physiology has drawn, in its turn, and in no small measure, from clinical medicine, to enrich itself in realms of human biology. It is common knowledge that one of the most accepted methods of the study of the physiology of functional units or integrated assembly of units is to produce an experimental organic lesion or a functional block. In disease, nature provides microscopic or macroscopic lesions in organs, whose sequence man cannot always reproduce. Morbid physiology, therefore, constitutes a scientific plank of physiological study. This is exactly what clinical medicine contributes to the growth of physiology and this aspect could be profusely exemplified. Studies in man on blood groups, on abnormal haemoglobins, on haemorrhagic diseases, and on abnormal thyroid function throw light on the genetic aspects of human biology. Further clinical researches on haemorrhagic diseases disclosed a variety of coagulation defects which threw new light on the mechanism of coagulation and rendered it possible to evolve a number of tests for the understanding of the sequence of events in coagulation. Studies in man on megaloblastic bone marrow, with or without cord lesion, led to a clear understanding of the role of folic acid and Vitamin B_{12}, in erythropoiesis, and investigations on liver disease led to the knowledge of the source of plasmaprotein fractions. Information on cardiac orrhythmias, congenital heart disease, pulmonary vascular shunts, oxygen and carbon dioxide transport in man helped to promote far better understanding of cardio-pulmonary physiology than on the basis of data from animals alone. Studies in man on kidney function in health and disease, on disturbances in the functioning of the urinary bladder in nervous disorders, on gastric fistulae in patients, on cortisone therapy in rheumatoid arthritis, on defects in colour vision, on lesions in orbitofrontal cortex, have all fulfilled similar purposes. A programme of study for over 20 years by Penfield and Jasper on the human brain, during surgical procedures, bore fruit in the shape of their monumental publication in 1954, *Epilepsy and Functional Anatomy of Human Brain.*

In the last few decades much could be achieved by collateral or integrated studies on animals and on human patients and this could be exemplified in the field of endocrines and hormones, nutrition, and metabolic disorders, the extensive studies made on trauma, burns, haemorrhage, and shock being typically illustrative of such a co-ordinated approach to physiological and clinical studies. The recent refinement in pulmonary function tests is yet another example of the co-ordinated study in animals and in man, in health and in disease. Conspicuous has been, in recent times, the rate at which data from animal experiments are substituted by those from the human, as exemplified in the cases of vestibular, high-altitude and space physiology. This augurs well for a bright future for human physiology to establish a sure foundation for the science of human illness, both of which constitute "a single corpus of knowledge of health of man" wherein all its components are equally interdependent.

Medicine has profited not only from physiology and other basic medical sciences but has also drawn fully from other sister disciplines since the days of Galileo to modern times. The biometry on astronauts and the "Telstar" intercontinental symposium on anaesthesia conducted on November 6, 1963, by the Chicago group and the London group of medical scientists are unique examples of the way recent knowledge of other sciences is harnessed for advancement in medicine and medical education. Medicine thus seems to be the single discipline which could assimilate the largest fraction of technical advances in sister scientific disciplines, not to

INTERDEPENDENCE OF PHYSIOLOGY AND MEDICINE

DR. P. BRAHMAYYA SASTRY

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PHYSIOLOGY, the science of life, is an independent discipline in its own right in the faculty of science, with its wide range of usefulness to medicine, agriculture, industry, etc. and even to the philosopher. It constitutes one of the foundations on which scientific medicine stands because medicine as the science of illness is not clinical assessment and therapy alone but an extension of the knowledge of science to that of disease. Even over a century ago, Claude Bernard realised that "the physiologist is the one who studies the science of life and seeks to bring into line with this the science of sickness; and the physician is the one who studies the sick man and uses physiology to enlighten and advance the science of disease." Faulkner (1959) says that the basic sciences are like the vocabulary and grammar of medicine. In the modern context, knowledge of physiology is used to a greater extent for evaluation of the function of the human body in health, disease and convalescence or rehabilitation. The experimental or investigatory procedures are rendered safer to man, and in this process physiology expands its horizons on account of the availability of data from human beings.

Instances are legion to convince oneself of the interdependence of physiology and medicine. Most valuable contributions to clinical science came out of the basic medical science laboratories and formed the basis for the remarkable advances in medicine. In the year 1855, Addison discovered that a symptom-complex, known thereafter as "Addison's disease," was caused by the malfunction of the suprarenal gland; and, in the year 1888, Horseley could show that thyroid deficiency was the cause of myxoedema. Nevertheless, medicine had to wait till 1904 for Bayliss and Starling to set the pace for scientific investigation into endocrinology by their remarkable discovery of the first hormone and the demonstration of hormonal control over body activity. In the field of nutrition, in spite of recorded descriptions in sailors, soldiers and others of nutritional deficiency states like scurvy, beri-beri and xerophthalmia, it was left to Sir F. G. Hopkins of Cambridge in the year 1912 to make the discovery, based on his animal experiments, of "accessory food factors" later known as vitamins, which had their remarkable impact on medicine. Likewise there are other fundamental but outstanding contributions of physiology, such as electrocardiography, electroencephalography, endocardiac pressure studies, blood flow measurements with flow meters and strain gauges, oximetry, hypothermia, etc., the usefulness of which in medicine is too well known. A few isolated instances, such as Goldblatt's work on experimental hypertension in dogs, studies on the role of folic acid and Vitamin B_{12} on nucleoprotein turnover in nerve cells, and the physiological basis for treatment of peptic ulcer, would certainly convince us of the positive contribution made by physiology to medicine. That sound knowledge of physiology helps to interpret the newer or problematic findings in medicine, is now a truism.

Physiology has drawn, in its turn, and in no small measure, from clinical medicine, to enrich itself in realms of human biology. It is common knowledge that one of the most accepted methods of the study of the physiology of functional units or integrated assembly of units is to produce an experimental organic lesion or a functional block. In disease, nature provides microscopic or macroscopic lesions in organs, whose sequence man cannot always reproduce. Morbid physiology, therefore, constitutes a scientific plank of physiological study. This is exactly what clinical medicine contributes to the growth of physiology and this aspect could be profusely exemplified. Studies in man on blood groups, on abnormal haemoglobins, on haemorrhagic diseases, and on abnormal thyroid function throw light on the genetic aspects of human biology. Further clinical researches on haemorrhagic diseases disclosed a variety of coagulation defects which threw new light on the mechanism of coagulation and rendered it possible to evolve a number of tests for the understanding of the sequence of events in coagulation. Studies in man on megaloblastic bone marrow, with or without cord lesion, led to a clear understanding of the role of folic acid and Vitamin B_{12}, in erythropoiesis, and investigations on liver disease led to the knowledge of the source of plasmaprotein fractions. Information on cardiac arrhythmias, congenital heart disease, pulmonary vascular shunts, oxygen and carbon dioxide transport in man helped to promote far better understanding of cardio-pulmonary physiology than on the basis of data from animals alone. Studies in man on kidney function in health and disease, on disturbances in the functioning of the urinary bladder in nervous disorders, on gastric fistulae in patients, on cortisone therapy in rheumatoid arthritis, on defects in colour vision, on lesions in orbitofrontal cortex, have all fulfilled similar purposes. A programme of study for over 20 years by Penfield and Jasper on the human brain, during surgical procedures, bore fruit in the shape of their monumental publication in 1954, *Epilepsy and Functional Anatomy of Human Brain*.

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speak of the basic medical sciences.

Therefore, it is clear that physiology should interest itself in the mode of function in disease as much as in health. On the one hand, it can develop, as a pure science, discovering new phenomena, without regard to their usefulness, from which medicine would draw amply for its advancement; and on the other hand, it can develop as an applied science, evolving purposeful methodology, instrumentation and other means of immediate avail to clinical medicine. Neither the physiologist who develops academic interests and prosecutes fundamental research without regard to its applied value, nor the clinician who formulates clinical research for immediate returns, need be apologetic. Each contributes squarely and surely, as the past has amply justified, to the progress of medical science.

Physiological knowledge provides the means for analytical and clear thinking, thereby shaking off intellectual inertia which often makes us walk on the easy path of dull routine or empiricism. The student acquires full faith in physiology as a foundation to medicine only when he is made to realise the underlying physiological principles of physical signs and symptoms and even of the formulation of therapy. For a career in a clinical speciality, the postgraduate student must return to a deeper study of basic medical sciences for a better comprehension of causal mechanisms in health and disease. A postgraduate curriculum and course content, which judiciously links up the basic science laboratory and the clinic, promotes a healthy integration of physiological thinking and clinical study. In this regard, Japan provides a model which we can follow both in medical education and in medical services. There the postgraduates in clinical specialities attend lectures and prosecute research in basic medical sciences, as a part of a four-year postgraduate course. To instil successfully into the mind of our postgraduate students the philosophy of interdependence of the branches of medicine, the initiative must start from the teachers themselves. They must incorporate basic medical sciences into bedside teaching and routine clinical investigations, most enlist participation of teachers in basic medical sciences in diagnostic clinical conferences and must send clinical teachers to laboratories for research work on problems involving basic medical sciences. This process will enthuse the postgraduate student to cultivate integrated appreciation of clinical medicine at the levels of routine investigation and the research project. These integrated postgraduate programmes could take a good shape if all the departments put their heads together. Clinical physiology laboratories and courses organised in the hospitals, as in some big hospitals of Sweden, provide yet another meeting ground for teachers and postgraduate students in clinical medicine and physiology. Any formal course or integrated training programme in clinical medicine for the postgraduates in physiology and in physiology for the postgraduates in clinical medicine, should be intensive and compact, and should extend over a period of six months out of the total postgraduate course which should spread over a period of at least three years instead of the customary two years. Further, the philosophy of the "first rate" enunciated by Ian Aird for postgraduate education must permeate every medical education programme.

IMPORTANCE OF PRACTICAL COURSE FOR POSTGRADUATE STUDENTS IN PHYSIOLOGY

DR. VISHNU D. MULLICK, PH.D.

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MORE and more teachers and research workers are urgently needed to take up suitable positions in the expanding departments of physiology in the medical colleges which are coming into existence under our "Five Year" development plans. Meanwhile, the burden of training candidates has fallen on the existing medical colleges, and their resources are being strained to the maximum. It is important at the present time to equip our future teaching and research personnel with the techniques of experimentation used in modern physiology, so that the knowledge acquired is broad-based and the work for further advancement in the future in this important but rapidly expanding scientific field could be handled properly.

In order to give such a training, we must plan a course of study both in terms of time and content, more so in view of wide variations in the standards of postgraduate courses and examinations which obtain today in the Indian universities. The variations in standards need not be alarming (in fact they are useful) provided a minimal basic course requirement of a uniform pattern, both theoretical and practical, is ensured.

The standard of any university is determined by the professor and head of department of the college/university and one of the reasons of the variation in standards, though not the only reason, is the emphasis placed on one or the other special facet of the subject in the department of physiology, both in the research institutions and in medical colleges in the country.

One of the necessary requirements for admission to a postgraduate course in medical science should be an adequate knowledge of physics, chemistry, biology and mathematics. But facilities for the learning of advanced physics, chemistry, biochemistry, biology, etc. do not exist in most of the medical colleges except those in the university campus. All postgraduate students of physiology should be expected to know the principles of physics in order to have an idea, for instance, of the concept of hydrostatic pressure, air and fluid flow measurement, principles of electricity and electronics, principles of radiation and so on. They should also be made to use simple and sophisticated instruments as illustrations in experimental procedures.

In the field of chemistry (physical and organic) and physiological chemistry, the students must be acquainted with principles of biochemical reactions as well as the use of such instruments as photo-electric colorimeter, spectrophotometer and microbalance, etc.

Similarly, the study of biology (zoology and botany) should include the use of advanced techniques, such as tissue culture, tissue transplantation, advanced microscopy, and the modern concept of tissue staining reaction.

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Therefore, it is clear that physiology should interest itself in the mode of function in disease as much as in health. On the one hand, it can develop, as a pure science, discovering new phenomena, without regard to their usefulness, from which medicine would draw amply for its advancement; and on the other hand, it can develop as an applied science, evolving purposeful methodology, instrumentation and other means of immediate avail to clinical medicine. Neither the physiologist who develops academic interests and prosecutes fundamental research without regard to its applied value, nor the clinician who formulates clinical research for immediate returns, need be apologetic. Each contributes squarely and surely, as the past has amply justified, to the progress of medical science.

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We are in a hurry.

A physiological life essentially implies the maintenance of equilibrium in the body in the face of constantly changing and even diversified external and internal environments. During the entire course emphasis should thus be put on the dynamic concept of living matter.

Only by receiving such a training would the future physiologist be able to shoulder the responsibility of teaching with confidence in the medical college or the research institutions in this country. The students should be made to develop self-reliance and inculcate a spirit of inquisitiveness through experimentation and they should get to know that "God sells knowledge for sweat."

Another prerequisite of a postgraduate student of physiology is the study of mathematics. Since the subject is not taught in medical colleges, suitable arrangement may be made with the department of mathematics of the university or the college. This course should at least include the study of logarithms as well as integral and differential calculus. This is required for a proper background of quantitative measurements, statistics and biometric analysis and as a part of training in mathematical biology. Such a course would help the training of the future physiologist in the art of exact thinking.

The university should arrange for the study of biophysics, biochemistry and mathematical biology for all the postgraduate students in the subjects of physiology, pharmacology, biochemistry, bacteriology and pathology at one place as far as possible.

Given the above background, the student of physiology at the postgraduate level should then be exposed to experimental studies in such facets of physiology as :

1. The study of fundamental physiology including general physiology and comparative physiology. In this study, experiments could be designed to acquaint the student with such general features as study of osmosis, membrane permeability, generation and recording of electrical potential, meosis, mitosis, etc.

2. The study of systemic physiology by taking the mammalian species as subjects of experimental exercises. Here, the need for proper handling of animals, and the care of acute and chronic experimental animals should be emphasised. Students should be encouraged and trained to propose a subject of inquiry; to design an experiment and execute a technique on an animal; and to keep proper record and suitably interpret it. Such research courses (theoretical and practical) may be designed for two to three months each with experiments on cardiovascular, respiratory, kidney, endocrine, and neuro physiology. During such studies, help from departments of pharmacology and experimental surgery, if available, could be utilised with profit. Alternatively, a short course in techniques of experimental surgery could be usefully arranged.

3. A postgraduate course in experimental physiology cannot be completed without exposing the student to semi-micro and micro techniques of biochemical measurements which include photo-electric colorimetry and spectrophotometry of body fluid constituents; study of enzymology; study of metabolic measurement including, among others, the use of the Warburg apparatus, electrophoresis, and chromatographic techniques.

4. The student should now be encouraged to study the human physiology both in health and in disease. Facilities could be made available in several clinical departments for physiological measurement. However, such a possibility requires extra effort on the part of the clinics in this direction and more often such help is not available.

Moreover, this course requires the whole-time attention of the postgraduate student for two to three years. If the student happens to be a member of the teaching staff, he should not be burdened with teaching work.

In most universities in India, there is the requirement of a thesis/dissertation for the M.D. course. The work for the thesis can surely be carried out alongside the practical course.

Education in thought and the method of exposition of the most important relative facts should be aimed at. Thus, the experimental course should be broad-based and should include all aspects of physiology. It should be taught intensively so as to minimise the time required.

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college and/or university. A personal interview of the candidate with the professor in charge of the department should be arranged.

DURATION OF TRAINING

The M.D. candidate should take three years' registration after obtaining M.B.B.S. and completing the compulsory rotating housemanship. The first year of this can be spent by working as a teacher or research worker in a recognised department of physiology. The remaining two years must be spent as a full-time postgraduate student or a teacher in a department of physiology recognised by the university for postgraduate training.

The M.Sc. degree (for those already possessing a B.Sc. (Sc.) degree should require four and a half years' registration in a recognised department of physiology. The first one and a half years should be spent by these candidates in getting orientation courses in physiology, biochemistry, anatomy and allied subjects of the type usually imparted to the undergraduate medical students. The remaining three years should be spent in training, similar to the training imparted to the M.D. students.

M.Sc. candidates with a B.Sc. (Physiology) degree should have three years of training. They should be utilised for teaching undergraduate and postgraduate students of physiology.

The Ph.D. degree should require a total minimum period of two years after the M.D. and three years after the M.Sc. may be spent as a full-time postgraduate student or teacher in a recognised department of physiology. During this period, these candidates should mainly concentrate on carrying out research on the projects of thesis, but they should also participate in undergraduate and postgraduate teaching.

METHODS OF TRAINING

The training for the M.D. and M.Sc. degrees should differ only in that the initial orientation course for non-medical students registering for the M.Sc. degree should be similar to that for Ist year M.B.B S. students.

The three years of similar training imparted to M.D./M.Sc. students should comprise a comprehensive course of study, basic as well as applied, in the whole field of physiology. This should include brief courses in history of physiology, comparative physiology, biophysics, histology (where histology is with the department of physiology), statistics, psychology and genetics. It was also considered desirable that postgraduates should have training in advanced physics, chemistry, biology and mathematics. Theoretical training should be imparted through a regular course of lectures and demonstrations, but, preferably, mostly by seminars in which the postgraduate students must actively participate. Stress should be put on applied physiology and advantage should be taken of the available clinical material.

REPORT OF THE SUB-COMMITTEE ON PHYSIOLOGY

DR. B. K. ANAND

Chairman and Professor of Physiology, All-India Institute of Medical Sciences, New Delhi

DR. M. L. GUPTA

Rapporteur and Professor of Physiology, S. M. S. Medical College, Jaipur

ONLY during the last 2 to 3 decades has it been realised by our authorities that, both for the proper training of medical students and for the advancement of medical sciences, well trained physiologists are necessary. The section discussed the important question of the ways and means of providing enough number of postgraduate students in physiology and whether non-medical physiologists should be utilised as teachers and research workers in the departments of physiology of the medical colleges. Medical graduates are not being attracted to physiology, mainly due to financial disparities and due to different service conditions existing for medical teachers and for other services. It was stressed that the economic status of medical teachers should be improved at least by adopting the minimum scales of pay recommended by the Health Survey and Planning Committee for the teachers of the undergraduate and postgraduate medical colleges. Suitable candidates who offer to take up physiology as career should be given a fellowship of Rs. 100 per month during the undergraduate course. The graduates who offer to do postgraduation in physiology should be given a stipend of Rs. 300 per month during their postgraduate course.

There was divergence of opinion about the feasibility of utilising non-medical physiologists as teachers, especially for teaching the undergraduate medical students. It was felt that they should be mostly utilised for research. One group, however, felt that they could be utilised as teachers if they were properly trained in the subject.

NOMENCLATURE OF DEGREES AND CRITERIA FOR SELECTION OF STUDENTS

Candidates for admission to the M.D. course must be medical graduates. Selection should be based on the merit of the candidate but preference should be given to those who are also B.Sc. (Physiology) or have distinction in physiology or who have either shown interest in the subject of physiology during their undergraduate course or done some research or teaching in this subject.

M.Sc. candidates should have previously obtained a B.Sc. in physiology or science. First preference should be given to those who already have a degree in physiology.

The Ph.D. course should be open only to those who have shown preference for research work at the M.D. or M.Sc. level.

Selection of candidates for registration for these degrees should be done on the recommendations of the professor in charge of the department and confirmed by a committee of the

teacher like associate professor, reader or assistant professor who also has a postgraduate degree and enough teaching and research experience.

In addition to the laboratory staff required for the undergraduate teaching, there should be at least two laboratory technicians available for assisting the postgraduate students in their research and practical exercises.

A physiology department, to be recognised for postgraduate training, must have a certain amount of research equipment, in addition to the minimum equipment required for undergraduate training. There should not be any hard and fast rules applying to what type of research equipment must be made available in such a department, as this will be dependent on the research interests of the senior staff members in the department (professor, reader, etc.). A certain amount of research equipment is essential as the postgraduate students have to be initiated into some research projects which they will take up for writing their thesis. In addition, they must carry out a number of experiments (practical techniques) which involve the use of the specialised equipment. As has been referred to above, the special practical course devised for any department of physiology for its postgraduate students will depend upon the type of specialised equipment available in the department.

Good library facilities should be available in the institution, which should be utilised by the postgraduate students to become familiar with the latest techniques in the field of their research project, as well as most of the recent literature in the subject of physiology. A photographic unit available to postgraduate students in the institution is also essential, and a central workshop (repair shop) must also be available for the use of postgraduate students.

EXAMINATIONS AND ASSESSMENT

A thesis is to form an integral part of the examination for the M.D. or M.Sc. degree and may be submitted before or after the examination.

Theoretical examination should consist of three papers of three-hour duration. There should be no paper on general medicine. The sub-committee appointed to draw up the curriculum, will also suggest the titles for the different papers.

There should be a practical examination in experimental physiology (including human and mammalian physiology). (In the universities where histology is part of physiology, there should be an examination in histology also.)

Day-to-day assessment of the postgraduate students is not considered necessary.

There have been two views on the system of examination. According to one, theoretical, practical and oral examinations should be held at the end of three years preceded by the approval of thesis. According to the other, theoretical and practical examinations should be held earlier. After this the student should work on the subject of his thesis and be given an oral examination on the thesis. The latter suggestion has been made to improve the quality of theses.

logy and submit his report to the Association within six months. He was authorised to co-opt members and to form a sub-committee for this purpose.

The group was strongly of the opinion that research should form an integral part of postgraduate training and the thesis should be of good quality. Each candidate for the award of the degree of M.D. or M.Sc. should be assigned a research project which should be the subject-matter of his thesis. This should aim at developing the faculties for planning of experiments, observation and interpretation of results, and the study of literature. The research project assigned to these candidates should be such that the student can extend these studies later on in the department where he is going to work after the completion of his postgraduation.

The postgraduate students should also actively participate in the undergraduate theoretical and practical courses.

It was recommended that the postgraduates should learn at least one foreign language other than English.

Candidates for the Ph.D. degree should be assigned a research project of a higher order. The subject of research would naturally depend upon the equipment available in the department and the research experience of the professor concerned. Candidates should also participate in undergraduate and postgraduate training.

REQUIREMENTS OF AN INSTITUTION OR DEPARTMENT TO UNDERTAKE POSTGRADUATE TRAINING

Any department of physiology, which has previously been recognised by the Medical Council of India as a suitable department for imparting training to the undergraduate medical students, can be recognised as a department suitable for postgraduate training, provided this department fulfils the other minimum requirements (given below) considered essential for a postgraduate department. If the department is properly equipped and staffed, it need not await the recognition of the whole institution (all the departments) by the Medical Council of India for imparting undergraduate teaching. This recommendation is offered keeping in view the fact that, in the newly emerging medical institutions, it may be possible for some departments to come up to a postgraduate level much earlier than the other departments. These departments, therefore, need not await the recognition of the whole institution by the Medical Council of India.

The department should have postgraduate laboratories available for the use of postgraduate students, in addition to the minimum laboratory facilities required for the undergraduate students. There should be laboratories for experimental physiology (including human and mammalian physiology) available to the postgraduate students, in addition to the availability of a histology laboratory in the institution. In addition to these laboratories, there should be small rooms available for the work of two to three postgraduate students. The department should have good facilities of an animal house as well as an animal operation theatre. There should be a seminar room for group discussions of the postgraduate students with the senior staff members.

For any department of physiology to be recognised for postgraduate training, it should have the service preferably of three but not less than two senior staff members who are qualified postgraduate teachers. Thus, in addition to the professor, there should be at least one more senior

DESIGN OF POSTGRADUATE TRAINING PROGRAMMES

Various committees at regional and national levels have recommended postgraduate training at two levels: (1) Training of a medical graduate for M.D. or M.Sc. in a subject. (2) Ph.D. The former is a two to three years' course given to graduates; the latter is a research degree to which candidates are eligible only after obtaining M.D. or M.Sc.

I. M.D. OR M.Sc. TRAINING

(*a*) *Background.* It may be admitted that a fresh M.B.B.S. or a science graduate has poor knowledge of chemistry, physics and mathematics. He receives insufficient training in biochemistry in his medical curriculum if he has passed from a college where biochemistry is taught as a sub-section of physiology. In such cases, the candidate will be required to go through a course giving him the fundamentals of the subject. (At the All-India Institute of Medical Sciences, such students attend the courses given to M.B.B.S. students.) Additional courses are prescribed during the following semester to familiarise the student with the essentials of organic and physical biochemistry and mathematics. In the next semester, the postgraduate course in biochemistry and molecular biology begins and continues through the rest of the training period.

(*b*) *Teaching methods.* Emphasis should be laid on self-education. The teaching programme could be organised in the form of seminars held regularly once or twice a week, where the subject is presented and disscussed by postgraduate students, senior research workers and teachers by turn. It will be beneficial if the students are exposed periodically to visiting scientists and teachers from other colleges and universities from India and abroad. At least one course by an eminent research worker or professor, not belonging to the department, every year is considered desirable. Such a course is also helpful and thought-provoking to the teachers themselves.

OUTLINE OF THE PROGRAMME FOR A THREE YEARS (OR SIX SEMESTERS) COURSE LEADING TO M.D. OR M.Sc.

1st Semester: Initiation in the fundamentals of biochemistry and biophysics. Acquisition of basic experimental techniques.

2nd Semester: Courses in essentials of basic subjects—physical biochemistry, bio-organic chemistry, mathematics and statistics; initiation of research projects.

3rd Semester to 6th Semester: Advanced courses in various branches of biochemistry and molecular biology; research work on the problem of the thesis, seminars. Teaching exercises.

An outline of the type of syllabus which could be covered during this period is to be found in Appendix I. It may however be emphasised that it is not the subject-matter that determines the quality and standard of training of a postgraduate, but the way in which the subject is covered.

AIMS AND CONTENT OF POSTGRADUATE EDUCATION IN BIOCHEMISTRY IN MEDICAL FACULTIES

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AIMS AND PHILOSOPHY OF POSTGRADUATE EDUCATION

THE aim of postgraduate education in biochemistry (as perhaps in many other subjects) is to develop professional proficiency and competence to a level which enables the candidate to preach and practice that discipline as well as the capacity to enlarge the confines of knowledge in that branch of science.

Postgraduate training seeks to inculcate traditions of scholarship and learning. Hence, it should promote the development of a critical mind and the ability to discover and to evaluate facts, both old and new. It should inspire the creative urge to seek new knowledge.

Postgraduate education does not consist in knowing only the known, but should be equally concerned with the unknown. A system of teaching which breeds passive familiarity only with facts is bound to be inadequate, as before long these facts will need revision in the light of the new knowledge. Therefore, learning has to be based on reasoning and it has to take due note of assumptions inherent in the reasoning process. A postgraduate student must be constantly critical in his thinking as in his outlook. Both, alas, are today sadly missing in much of what is styled as postgraduate education.

REQUISITES OF POSTGRADUATE TRAINING

Being an experimental science, the process of acquiring knowledge in biochemistry is not different from that in other experimental sciences. It is in an atmosphere of investigation and research that sound postgraduate training in a subject like biochemistry can be given.

These considerations have important consequences. It follows that, if these aims have to be fulfilled, active research groups have first to be developed before postgraduate degrees and training programmes are instituted in a college. The need for the expansion of postgraduate facilities is fully realised, but what is not realised is that an inadequate postgraduate training is no training at all. It is dangerous both in its immediate and long-term effects. It will lower scholastic standards and calibre of those who are going to be teachers. Flooding the country with degrees without sound training is in no way helping the cause of education. In contrast to many other fields, we must realise that it is not the *number* but the *quality* which is important and which we must endeavour to attain. We will be failing in our aims if we enforce or legislate postgraduate degrees in colleges where active and fruitful research is not yet established.

IV. Enzymology

Nature of enzymes, cofactors, coenzymes and posthetic group, catalysis, classification of enzymes, purification of enzymes, kinetics and mechanism of enzyme action.

V. *Chemistry of Blood*

Chemical composition of blood, plasma proteins and their function in the body.

VI. Digestion and Absorption

Salivary secretion and digestion. Gastric and intestinal digestion. Role of bile in digestion. Absorption of carbohydrates, fats and proteins, experimental and clinical methods of GIT investigation; intestinal putrefaction and mechanisms of detoxication.

VII *Vitamins and Nutrition*

Chemistry and metabolic role of vitamins (A, D, E, K) and Coenzyme Q; thiamine, lipoic acid, riboflavin, pyridoxine. niacin, panthothenic acid, biotin, folic acid. Vitamin B_{12}, Vitamin C and P. Dietary sources, deficiency states, metabolic and physiological role. Nutrition: general notion, energy metabolism and BMR; nutritive value of principal articles of food, balanced diet. Diet in health and disease.

Paper II—*General Biochemistry, Metabolism and Regulatory Mechanisms*

I. Intermediary Metabolism of Carbohydrates

Glycogenesis, glycogenolysis, gluconeogenesis, glycolysis, tricarboxylic acid cycle, alternate pathways of carbohydrate metabolism in animal tissues, metabolism of other sugars—galactose, fructose, pentoses, aminosugars; uronic acids; metabolism of mucopolysaccharides.

II. Intermediary Metabolism of Lipids

Essential fatty acids; oxidation of fatty acids, ketone bodies formation, biosynthesis of triglycerides and phospholipides and biosynthesis of cholesterol and its functions, lipotropism.

III. Biological Oxidations

Structure of mitochondrion, electron transport chain and oxidative phosphorylation.

IV. Intermediary Metabolism of Proteins

Significance of proteins; nitrogen balance; deamination; decarboxylation and transamination of amino acids; biosynthesis of urea, nitrogenous constituents of urine; metabolism of amino acids: phenylalanine, tyrosine, tryptophan, glutamic acid, cysteine methionine, glycine and serine. Biosynthesis of proteins *in vivo* and *in vitro* systems.

V. Intermediary Metabolism of Nucleic Acids

Biological functions of nucleic acids. Biosynthesis of purine and pyrimidine nucleotides. Role of various nucleotides in cell metabolism. Structure and biosynthesis of DNA. Various types of ribonucleic acids, biosynthesis of RNA; genetic code.

TRAINING FOR PH D

The programme is essentially the same as for M D and M Sc students from the second semester onwards The requirement for Ph D is a research work of high calibre Research is the core of his training and it is around this central activity that seminars and other post graduate exercises as enunciated for M Sc and M D are built Before a student is recommended for Ph D, it should be assured that he has made some original contributions to the knowledge on the subject

TRAINING IN BIOCHEMISTRY FOR POSTGRADUATE STUDENTS IN OTHER MEDICAL DISCIPLINES

Postgraduate training in any medical or surgical discipline demands familiarity to some extent with biological processes at cellular and molecular levels This necessity could be fulfilled by

(*a*) Assigning of the student by the professor concerned for completing a number of courses considered essential from the standpoint of his discipline These courses may be chosen from those given by the biochemistry department as a part of its postgraduate or undergraduate training programmes

(*b*) Residential training of the student for 3 to 12 months (depending on the subject) in the department of biochemistry

A combination of (*a*) and (*b*) will be beneficial in most cases

APPENDIX 1

Syllabus for M D (Biochemistry)
at the
All India Institute of Medical Sciences, New Delhi

THEORY

Paper 1—*General Biochemistry*

I Elements of Biophysical Chemistry

Structure of atom and molecules, valency, radio isotopes, Donnan's equilibrium, osmosis, viscosity, surface tension colloids, pH, indicators and buffers and methods for characterisation of macromolecules

II Chemistry of Biological Compounds

Chemistry of carbohydrates, lipids, proteins, nucleic acids

III Chemical Composition of Tissues

Nervous tissue muscles, connective tissue, epithelial tissue, bone, etc

V. **Biochemistry as a Diagnostic Aid in Medicine**

Clinical chemistry as an aid to diagnosis. Enzymes and isoenzymes in clinical medicine.

Syllabus for M.D. (Biochemistry)

PRACTICAL

Part I—Clinical Chemistry

Blood: Sugar; NPN, urea; uric acid; creatine and creatinine.

Serum: Total proteins; A.G. ratio; total cholesterol and free-ester ratio; total bilirubin and direct-indirect ratio; ketone bodies; alkaline phosphatase and acid phosphatase; amylase, salicylate, Na, K, Ca, Cl and P.

Urine: Albumin; Sugar, Na, K, Ca, Cl and P; Bence-Jones protein; creatine and creatinine; diastase; uribilinogen and total porphyrins.

CSF: Cl, sugar; total protein and globulin, Lange's colloidal gold curve.

Stool: Tryptic activity, fats (split and unsplit) and stercobilin.

Ascitic Fluid: Total protein.

Pleural Fluid: Total protein.

Gastric analysis: Qualitative and quantitative.

Special tests: Kepler's test; urea clearance test; urea concentration test; glucose tolerance test.

Part II—Advanced Clinical Chemistry

PBI, ketosteroids and 17-hydroxy-steroids; transaminases (SGOT & SGPT), electrophoresis of serum proteins, chromatography of amino acids and sugar.

Part III—*Instrumentation and Techniques*

pH-measurement; photocolorimetry and spectrophotometry; flame photometry; manometric techniques; column chromatography; subcellular fractionation and gradient centrifugation.

Part IV—*Use of Radio-Isotopes in Research and Clinical Diagnosis*

I^{131} in assesment of thyroid function; labelled Rose-Bengal scanning for diagnosis of liver disorders; use of P^{32}-orthophosphate and C^{14} in research. (plating, counting-GM tubes, scintillation detectors and internal proportional counters.)

Part V—*Chemical Analysis and Techniques Related to the Topic of Research*

VI Mineral Metabolism

Metabolism of Na K Ca, Mg, Mn Fe Co, Mo, Zn, F, Cl, I and P

VII Endocrines

Chemistry and physiological action of hormones (anterior and posterior pituitary, thyroid, parathyroid, insulin glucagon, adrenal crotex, adrenal medulla and gonads) Regulation of secretion, hypothalamo hypophyseal relationship, biological and metabolic effects, mechanism of action of hormones and homeostasis

VIII Regulatory Mechanisms

Interrelationships in intermediary metabolism, regulation at enzymic and genetic level

Paper III—*Biochemistry in Relation to Pre and Para clinical Disciplines*

I Ultra structure of cells and cell organelles

II Membrane phenomenon

III. Elements of biostatistics

IV Systemic Biochemistry

Chemistry of respiration, chemistry and mechanics of muscular contraction, excretory system neurochemistry, transmission of nerve impulse

V. Water and electrolyte balance Acid and base balance

VI Principles of chemotherapy

VII Essentials of immunology

VIII Biochemistry of growth and development

IX Radio isotopes and essentials of radiobiology

Paper IV—*Biochemistry in Relation to Clinical Disciplines*

I Biochemical Lesion

Disease at cellular and molecular level

II Biochemistry of Various Diseases

Epilepsy, diabetes, uremia myocardial infraction, hepatic coma

III Metabolic Disorders and Congenital Abnormalities

1 Disorders of carbohydrate metabolism galactosemia, pentosuria, glycosuria, glycogen storage diseases

2 Disorders of fat metabolism atherosclerosis ketosis, various types of lipoidosis

3 Disorders of protein metabolism malnutrition aminoaciduria, inborn errors of amino acid metabolism abnormal haemoglobins porphyrinuria

IV Assessment of Organ Functions

Liver and kidney function tests adrenal and thyroid function tests, gastric function tests, assessment of diabetic state

should be made for the maintenaoce aod repair of such instruments hy the specialities which own these instruments. Special staff for maintenance of such iostruments will have to be provided wherever necessary, and it is desirable that plans are made so that someone is made responsible for each of the major equipments for its maintenance in proper working conditioo. The necessary foreigo exchange should always he made immediately available for replacement of parts, repairs, etc.

It will be apparent from the proposals given above that the co-operatioo with other biochemistry departments outside medical colleges will be helpful io establishiog the postgraduate ceotre. Io Madras, the students of biochemistry in the medical faculty and those in the science faculty are jointly looked after hy the biochemistry department of the Madras Medical College and the hiochemistry departmeot of the University. This has increased the scope of teaching and research work in both the departments withnut increasing very much the expenditure on equipment, chemicals aod other requirements.

RELATION TO THE DEPARTMENTS OF PHYSIOLOGY, PATHOLOGY AND CLINICAL SCIENCES

(*a*) *Physiology*. Biochemistry has grown to be an independent subject aod is no longer coosidered a part of physiology. As such, I do not consider that close relation oeed exist hetween these two departments. However, a course of lectures and practicals io physiology will he indispeosable for all candidates who specialise in any hranch of hiochemistry, as long as they are not graduates in medicine. But hiochemistry is indispensable for all postgraduates io physiology whether they have a degree in medicine or not. To that exteot facilities should he provided in the hiochemistry departmeot for the training of postgraduate studeots io physiology. A course of lectures and practicals in the hiochemical techniques necessary for the particular hranch of physiology in which the candidate is specialising may also he arranged.

(*b*) *Pathology*. The advaoces made in hiochemistry are such that this subject canoot he called "chemical pathology" aoy longer although hiochemistry as applied to medicine is nowadays designated as "Lahoratory Medicine." Therefore, its relation to the pathology department can ooly he limited. The modern laboratory methods in hiochemistry are so advanced that ordinarily a pathologist will not he capahle of running a modern hiochemistry laboratory without the assistance of a skilled biochemist. But when such a skilled hiochemist is available, it is desirable that he should belong to the biochemistry departmeot rather than to the department of pathology and he a chemical pathologist. It is desirahle that clinical pathology and chemical pathology are separated and that the former is assigned to the pathology department and the latter to the department of biochemistry. The postgraduates in pathology could attend relevant lectures and practicals in hiochemistry which are always giveo to the postgraduates of the hiochemistry department.

(*c*) *Clinical Sciences*. The two sections in the hiochemistry department, especially clinical biochemistry and food and nutrition, and to a lesser extent the other sections ought to have a very close relation with the clinical sciences, viz. medicine, surgery, midwifery and gynaecology and preventive medicine.

The clinical biochemistry section of the postgraduate department of biochemistry, therefore,

STRUCTURE AND FUNCTION OF POSTGRADUATE DEPARTMENT OF BIOCHEMISTRY AND ITS RELATION TO THE DEPARTMENTS OF PHYSIOLOGY, PATHOLOGY AND CLINICAL SCIENCES

DR. NINAN VERGHESE

STRUCTURE OF THE POSTGRADUATE DEPARTMENT OF BIOCHEMISTRY

BIOCHEMISTRY is a very rapidly developing subject and the recent advances are so extensive that a postgraduate department in the subject should be planned in a comprehensive manner, providing facilities for studies and research in all advanced topics. Ordinarily, this is beyond the scope of most medical colleges including those where a separate department of biochemistry exists.

Clinical chemistry which forms most of the teaching of biochemistry in medical colleges should form one of the major specialities in the postgraduate department of biochemistry. The other specialities being (2) food and nutrition, (3) vitamins and hormones, (4) protein chemistry, (5) tracer techniques and radioactivation analysis, (6) microbiology and genetics and (7) enzymes and intermediary metabolism. Each of these specialities should have an associate professor, a reader and a lecturer, except clinical biochemistry which should have two of each. The subordinate staff should be the same as in postgraduate courses in the university. One of the professors in the seven specialities who has good publications to his credit and has administrative ability may be appointed director for a term, after which the post may be open to any one else in the department who shows outstanding abilities in his field. It will also be desirable to invite eminent professors from abroad to fill the post of director on short-term basis. The associate professor of clinical biochemistry should have a medical qualification and should be given a suitable non-practice allowance. His scale of pay otherwise may be the same as that of other associate professors in the department. It is desirable that no distinction is made between medical and non-medical biochemists in the department.

FUNCTIONING OF THE DEPARTMENT

Except for supervisory and administrative control by the director, each speciality should function as an independent unit with separate budget and powers to spend money out of their budget. This is absolutely necessary so that the research work of the department is not hampered. Full interdepartmental co-operation is desirable in planning research work. Registration for postgraduate degrees may be broad-based and should be under the direction of one or more of the associate professors with facilities for the student to work with as many of the associate professors as the scheme might require.

The important and expensive equipment of the postgraduate institute should be placed under the charge of a fully trained lecturer for the use of research students, and budgetary provision

POSTGRADUATE EDUCATION IN BIOPHYSICS

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DEFINITION

BIOPHYSICS includes the study of biologic structure and function in terms of the concepts of physics and mathematics and the influence of physical forces on the organism and its various component systems. The term medical physics connotes a specialised facet of biophysics and is used when the study is of relevance to medicine.

IMPORTANCE

Biophysics has recently assumed tremendous importance. We have passed the era where biophysics meant simple experiments of osmosis, diffusion, electrolyte transport, the study of electrical potentials or manometric studies of cell respiration. It is being realised today that the concepts of physics may be crucial for gaining an intimate understanding of some of the fundamental and most mysterious phenomena associated with "life." Biophysics has amply proved to be a science of fundamental importance to life sciences. Sub-molecular biology, electrophysiology, bioelectronics, biomedical engineering, radio-biology, membrane biophysics, photobiology, muscle contraction, cybernetics, quantum biology, all demonstrate the applications of biophysics touching all aspects of life (see Appendix I).

POSTGRADUATE TEACHING

The need for postgraduate education in biophysics is universally recognised. How should this be organised? Biophysics is a merging discipline where concepts of general physiology, biochemistry, pharmacology, anatomy, and pathology intermingle with diverse fields of physics like electronics, optics, spectra, quantum physics, nuclear physics, etc. Therefore, the department of biophysics which will have the readiness to participate in the growth of biophysics and anticipate its future development must consider the training in the fundamental physical concepts and trends in instrumentation in relation to the integrated organism as its motto. This should have relevance to all aspects of structure and function in health, in disease, and under the influence of food, drugs and forces of environment. Such a schedule is feasible and is presented in Appendix II.

Taking, therefore, the objectives of high quality research and awareness of the broad aspects of biophysics into consideration the following is proposed as an ideal solution which can be readily put into practice, and has indeed been used at the Ph.D. level in the All-India Institute of Medical Sciences, New Delhi.

FOR THE Ph.D. DEGREE IN BIOPHYSICS

Persons should be considered eligible if they have: (a) an M.Sc. or M.D. in biophysics or

will turn out to be the largest section and so should be further divided into two sections. One section should handle the routine biochemical analysis for the hospital which will be about 30,000 analyses a year for a 1,000-bedded hospital. Assistants who have received special training will have to be employed in this section and they will take over the biochemical analysis for the maintenance of the following cases in the hospital:

(a) Surgical cases and others requiring maintenance of fluid and electrolyte balance.
(b) Artificial kidney and haemodialysis in patients.
(c) *Biochemical analysis for anaesthetist in hypothermia and other cases requiring prolonged anaesthesia.*
(d) *Biochemist for cardiac surgery cases and gas analysis for intracardiac catheterisation.*
(e) Biochemist for metabolism unit.

More specialised biochemists like neuro-biochemists will have to be employed if the neurosurgical speciality is to be served.

The second section of the clinical biochemistry department will have a close liaison with all the clinical science departments only as far as research and special investigations are concerned. They will have no load of routine analytical work. They will also collaborate with the other sections of the biochemistry department and will have students taking up M.Sc. and higher research degrees. The clinical material of the hospital should be made available to the postgraduate students for research. The clinical professors could co-operate with the biochemistry department in publication.

in medical physics. They should take up the course after a minimum period of work for two years which should comprise independent research as well as course work in an area of specialised interest as exemplified in Appendix III. (*b*) M.Sc. or M.D. in medical specialities other than biophysics, M.Sc. in other life sciences or in physical sciences, including the M.Sc. or M.E. in electronics. They should be eligible for Ph.D. in biophysics after a minimum period of work for three years of which one year will be spent in undergoing an orientation programme which will be designed to impart sufficient knowledge in biology to the students of physical sciences and of electronics and in physics to the students of life sciences. Further inscription for the doctoral programme will depend upon the performance at the end of the orientation course. Those who do not perform well but show some promise may be provided another opportunity to undergo the orientation course. If still found unsuitable, the candidate should be directed to undertake only an M.D. or M.Sc. programme, depending upon his previous background. (*c*) A B.Sc. in basic medical sciences and medical graduates who are interested in pure research in biophysics may be permitted to proceed for the Ph.D. degree without going in for the M.Sc. or the M.D. degree, after a minimum period of four years.

It should be noted that the B.Sc. degree in "Basic Medical Sciences" has been envisaged as a separate four-year degree course after the passing of the High School examination or an equivalent examination under the auspices of a medical college or preferably a university, covering the following topics of human biology:

Anatomy, Histology, Cytology, Embryology
Physiology
Psychology and Elements of Sociology
Biochemistry
Biophysics, Biomathematics and Biostatistics
General Pharmacology
General Pathology

When such a degree course becomes available, it will leave the option to the graduates either to proceed towards a 2½ or 3 years' course in clinical and paraclinical sciences and obtain an M.B.B.S., or to work toward postgraduation in any subject of the course undertaken.

The final assessment in all cases should include a "comprehensive" test, to judge the extent of the grasp and the teaching capacity of the candidates as well as a public defence of the candidate's work to assess his depth in the subject of research.

FOR THE M.D. DEGREE IN BIOPHYSICS

Medical graduates with basic clinical training or medical persons who have been unable to obtain sufficient background even after two years of the orientation programme for Ph.D. in biophysics should be admitted. They should be assessed for the M.D. degree after a minimum duration of two years of courses following the submission of an acceptable dissertation in the field of medical physics. The courses shall include, among other applied and allied aspects of biophysics, a proper orientation towards biophysics and quantitative biology (Appendix IV). The dissertation shall have some distinct relevance to experimental or clinical medical physics.

polarizing attachment for photomicrography and microprojection. One small table model electron microscope for low magnification, electron microscopy, with one microtome for light microscopy and one for electron microscopy, tissue processing assemblies, one carbon evaporator, and dark room facilities for black-and-white and colour photo processing and an optical bench should be available.

The biophysical chemistry laboratory should offer facilities of a few microbalances, semimicrobalances and ordinary balances, potentiometric titration assemblies, at least one refrigerated centrifuge, two ordinary centrifuges, two Warburg apparatuses, two pH meters, one spectro-photometer, two colorimeters, three paper and three column-chromotography assemblies, three electrophoresis assemblies and two sets of Courtauld type atomic models, two sets of "ball and rod" atomic models and models of crystal lattices and helices. Two oscilloscopes and electronic components and assemblies for demonstration of recording, read-out, monitoring and testing assemblies are also necessary for the bio-electronics section along with facilities for trouble-shooting, servicing, machining and model building.

In addition to these equipments, one should also have facilities of high resolution and low temperature electron microscopy and electron diffraction, for X-ray diffraction (low and wide angle), X-ray spectrometry and X-ray fluorescence analysis, quantitative polarising microscopy and optical diffraction. In the biophysical chemistry laboratory β and σ counting equipment including scintillation spectrometer and facilities for infrared and ultraviolet spectrometry by transmission and reflectance at controlled temperatures, dual wavelight differential spectrophotometry, electron and nuclear paramagnetic resonance spectrometry, differential manometry, ultra-centrifugation and oxygen polarography, radioautography, freeze-drying, flame photometry should be provided. A digital computer is essential and a good departmental library in biophysics with journals, data cards, and books is obligatory. There should be room enough for using the equipment.

GENERAL ADMINISTRATION

Fullest attention should be paid to reduction of red tape in the procurement of equipment, components, reagents, chemicals, animals, glassware, etc. Foreign exchange should be made available without much difficulty for the above and for books and journals. These factors are the greatest impediments to creative work.

CONCLUSION

It is firmly believed that, for the rapid growth of biophysics, the programme suggested above has the merit of meeting the challenges of the future with the greatest of economy. An idea of what the departments of biophysics can contribute to other departments in teaching and research is reflected in Appendices I and V.

RESPONSIBILITY FOR UNDERGRADUTE TEACHING

Although the aim of the conference is to discuss postgraduate medical education and the above comments are about the postgraduate students of biophysics, it may be mentioned and emphasised that no postgraduate programme can succeed unless good teaching has been done at the undergraduate level. It is, therefore, to be recommended as strongly as possible that an inde-

(*b*) Mechanics of the body. Elasticity of biological tissues. Breaking strength of bones. Relaxing and creeping properties of tissues.
(*c*) Biophysics of muscle contraction and muscle strength.
(*d*) Hydrostatics. Flow of viscous fluids in biological system. Energetics of blood flow.
(*e*) Gas physics of respiration.

2. Heat
   (*a*) Temperature regulation, homiothermy, poikilothermy. Insulation and endurance against extremes of temperature.
   (*b*) Heat as a therapeutic tool.

3. Bioaccoustics
   (*a*) Clinical applications and pathological effects of sound and ultrasound.
   (*b*) Biophysics of the direction of sound.

4. *Light*
   (*a*) Biological effect of light.
   (*b*) Light as a therapeutic tool. Infrared therapy.
   (*c*) Optics and molecular biology of vision.

5. Electricity and magnetism
   (*a*) Effect of electricity on the body.
   (*b*) Effect of magnetic field on biologic system.

6. Nuclear and atomic forces

   Absorption and effects of all types of radiation on tissues, including effect and use of maser or laser beam. Low natural radioactivity of the body.

SECTION C

Interpretation of biologic structure and function from the point of view of laws of physics and mathematics

1. Molecular biology

   Ultrastructure: Analysis of biologic systems to obtain their molecular composition and constitution and establishment of characteristics and structure of these molecules.

   Function: Analysis of biologic function on the basis of alteration of molecules during the course of functional states of biologic systems.

   Various methods mentioned in Section A are applicable.

   These studies include also the study of Quantum Biology to give an understanding of sub-molecular basis of reactions. Study of charge transfer spectra, mode of energy transfer free radicals, infrared or ultraviolet study of flow systems are some of the experimental approaches. Works of Pullman and Pullman on carcinogenic and other molecules, Wilson and Koshiland on mechanism of some

(*i*) EPR and NMR spectroscopy
(*j*) Light scattering nephelometry
(*k*) Raman spectrography
(*l*) Refractory and polarimetry

(*ii*) *Physical-chemical techniques*

(*a*) Tracer techniques using stable and radioactive isotopes
(*b*) Radiation dosimetry. Study of therapeutic radiation fields
(*c*) Study of sedimentation, diffusion and viscosity. Analytical ultracentrifuge. Density gradient centrifugation
(*d*) Surface film techniques, including study of surface film potential. Surface chemistry and irradiation of surface films of proteins.
(*e*) Adsorption, counter current distribution and chromatography. Slow and rapid mixing methods for study of biochemical kinetics
(*f*) Electrophoresis including immune electrophoresis. Ionophoresis.
(*g*) X-ray diffraction and scattering
(*h*) Magnetic susceptibility measurements
(*i*) Masometric techniques for single cells, including Cartesian diver technique
(*j*) Thermal conductivity measurement methods as, for example, those used in analysis of respiratory gas
(*k*) Intracellular pH and osmotic pressure determination
(*l*) Polarography and electroanalysis
(*m*) Titrations: potentiometric, amperometric, conductiometric, thermometric and high frequency

(*iii*) *Biomedical engineering for the study of biologic systems and for therapy*

(*a*) Use of ultrasonics for flowmetry, tumour localisation. Television techniques and telemetry. "Microsonde," endoscopy, currioscopy, electrode probes, etc. Analytic E.C.G., E.E.G., electromyography; electrooculography; electroretinography.
(*b*) Microphotography.
(*c*) Artificial organs—heart, kidney, larynx reading devices for the blind, hearing aids and protheses for lesions in skeleton.

(*iv*) *Study of isolated systems*

Analytic organ perfusion, tissue culture and quantitative study of cell responses, ciliary movements, cell contact, etc.

SECTION B

Study of the effects of physical forces on biological systems

1. **Gravitation and mechanical forces**

(*a*) Effect of G forces in flight and in human centrifuge of low and high pressure and simulated altitude, etc.

13. Quantitative histo- and cytochemistry and radioautography including cytophotometry.
14 Biomolecular structure determination and study of their interactions including X-ray and electron diffraction on biologically important molecules and biological systems.
15. Molecular or energetic basis of action of enzymes, co-enzymes, co-factors, hormones, vitamins, drugs, antigens and antibodies and the gene.
16. Electron transport and energy capture in the cell.
17. Bioluminescence.
18. Biomedical engineering, including biophysics and development of prostheses.
19. Radiation desimetry and radiation biology including photosynthesis and photosensitization.
20. Cybernetics.
21. Coding and decoding of genetic information.

APPENDIX II

Orientation programme in biophysics, addressed to candidates with background in life sciences as well as to those who have background in physical sciences including electronics

1. BIOMATHEMATICS (SPECIALLY FOR PERSONS WITH BACKGROUND IN BIOPHYSICAL SCIENCE)

Measurements. Errors of observation. Practice problems in dimensional analysis. Logarithms. Algebraic preliminaries like equations including quadratic and simultaneous equations, imaginary quantities, maxima and minima, surds, partial fractions, permutations and combinations. Elementary trigonometry. Angular velocity. Simple harmonic motion. Series, especially series C. Functions and their graphical representation. Nomography. Differentials and differential coefficients. Maxima and minima. Successive differentiations. Integral calculus. Thermodynamics. Differential equations. Fourier's theorem. Co-ordination of experimental results (e.g. determination of the order of chemical reactions, derivation of empirical formulae connecting more than two variables, etc.). Biometry and the design of experiments. Use of the slide rule.

2. *BIOPHYSICAL CYTOLOGY AND MOLECULAR BIOPHYSICS*

Topics

1. Definition of biophysics
   Living and non-living matter cell. Cell physiology. Organisation of biophysics and literature in biophysics.

2. Biophysical methods for the study of cell structure and function
   Microscopes.
   Absorption and emission spectroscopy.
   Ionizing radiation.
   X-ray methods.
   Ultracentrifuge and other methods of determination of molecular shape and size.
   Radioisotopes.

enzyme action, Poalina on sodium ion and guanidinium ion $C(NH_2)_3$, Grade on electron transport members, Fukui on choline pheyl ethers, etc. are examples in point.

Molecular biology includes aspects of physiology, biochemistry, pathology and pharmacology at molecular level as elucidated above.

2. Energetics

Biological systems, at tissue or organ level (e.g. Goodall's work on muscle contraction) as well as at the level of biophysical chemistry. Energy metabolism of the body.

3. Theoretical biophysics

Model erection and mathematical analysis of biologic phenomena, e.g. membrane transport, assay of radioactivity, cybernatics, calculation of information function of ion transport, navigation in birds, flies, etc. Biostatistics.

4. Electrical system in biology

(*a*) Passive electrical properties of tissues.
(*b*) Membrane response to excitation.
(*c*) Surface potentials on the animal body, including the potentials in the electric fishes.
(*d*) Electric diagnosis, electrotherapy and diathermy.

5. Magnetic susceptibility of biological systems

SECTION D

Predominantly current areas of biophysical research

In the light of Sections A, B, C given above, the following fields are considered largely biophysical:

1. Aviation medicine and effects of high altitude.
2. Physiology of cold stress.
3. Physiology of arid environment.
4. Space medicine.
5. Membrane transport.
6. Bioelectric potentials.
7. Muscular contraction.
8. Physiology of vision.
9. Physics of the ear.
10. Mechanics of respiration and physics of transport and exchange of gases.
11. Cardiac and haemodynamics and blood coagulation. Thrombosis. Fluid flow system in general.
12. Special microscopy, viz. phase, interference, fluorescence, polarizing, X-ray and electron microscopy.

8. **The Physics of celullar processes and fonctions**

   Growth, replication, division, differentiation.
   Replication of cell structure, a general scheme of metabolism of proteins, nucleic acids, lipids, structural carbohydrates, minerals, derivatives and water.
   Ageing and resoscence.
9. Response of cell to pathogens.
10. The mechanism of various groups of drugs.
11. History of biophysics and biophysical cytology.

3. STRUCTURAL AND REACTION CHEMISTRY

1. **Qualitative electronic theory of organic chemistry**

   Nature of bonds (π & σ) in organic structures—their electronic and directional characters; functional group and their electronic characters; inductive and conjugational (mesomeric or electromeric) effects in simple compounds—explanation of the behaviour of organic acids and bases; unsaturation in aliphatic compounds—hyperconjugation; aromatic character—the structure of benzene; conjugation resonance and structure and conjugation—colour and constitution; free radicals; a brief survey of some organic reaction mechanisms.

2. **Steric effects in organic chemistry**

   Stereochemistry—optical isomerism; configuration; geometrical isomerism about double bonds, geometrical isomerism and conformation in cylopentane derivatives; steric hindrance and its electronic and geometrical influence on structure; geometry in biochemical system; H bonding and chelation.

3. **Physical properties and structure**

   Polarization and dipole moment; refractive index and some other properties; absorption in ultraviolet and visible regions—various factors—Inductive conjugational and steric—examples: infrared absorption, nuclear magnetic resonance, spectral and constitutional problems. Fluorescence
4. Determination of organic structures and synthetic methods in organic chemistry.

4. ELECTRONICS AND INSTRUMENTATIONS

The system concept. The theory of instrument. Order of instruments. Fundamentals of electricity. Aspects of network analysis. Vacuum tubes. Amplifier circuits (various types), oscillator circuits, stimulators. Time-base generators. Power supply circuits. Detecting and sensing instruments. Recording and read-out devices. Instrumentation schemes. Trouble shooting instruments. Transistors Computors. Uses of lathe and milling and boring machines.

Instruments used in animal experimentation. Bio-electronics, X-ray diffraction and biophysical chemistry.

3. Biophysicist's view of the body and the cell

(*A*) General structural plan of the body.

Types of tissues.
The cell by light microscopy.
Sample preparation, staining, basic histochemical techniques.
The ultrastructure of tbe cell (including bacteria viruses and phage).
Cell growth and division
Molecular composition of tbe cell.

(*B*) Structure of the biological important molecules.

(*C*) Principles of molecular structure.

Atoms and molecules.
Intramolecular and intermolecular forces.
Molecules in solution.
Colloidal properties of cytoplasm.

4. The milieu and the cell

Water, gases, salts, pressure, acidity, pH, temperature.
Effect of radiations on cell.
Action spectra and quantum yields.

5. Nutrition and metabolism of the cell

Enzyme and enzyme action.
Energetics, thermodynamics, statistics and the information theory.
Biological avenues of making and breaking of bonds, oxidation, oxidation reduction potentials, cellular respiration, glycolysis, fermentation, photo-synthesis, bioluminescence, coupled reactions.

6. Exchange of materials across cell and other membranes and the constancy of millieu interim.

Osmosis, movement of solutes in response to a concentration gradient, active transport, "secretion" of acid, wastes and hormones, detailed structure of cell membrane and other membranes.

7. Irritability and responsiveness of the cell

Response in plants and animals.
Electrical properties of membranes.
Action potentials of cells.
Contractivity.
Contraction of muscle, specially cardiac muscle.
Nature of receptor organs.

(*e*) Theoretical biophysics

Quantum chemical evaluation of the structure of biologically important molecules and the analysis of various concepts used in biology, e.g. matrix theory in radioautography, identification of precursors in biochemical reactions coding and information theory, "organisation," "control," etc.

Note: Candidates wishing to select *a*, *b* or *c* as the special topics will undergo a course in advanced mathematics as follows:

Thermodynamics. Ordinary differential equations. Special functions (Gramma, Legendre, Polynomials, Bessel, Hermite and Laguerre). Vector analysis. Co-ordinate systems. Calculus of variation. Laplace's equation. Poisson's equation. Eigenvalues and eigenfunctions. Mechanics of molecules. Matrix algebra. Quantum mechanics. Statistical mechanics Group Theory.

APPENDIX IV

Syllabus for training programme in biophysics for the M.D. degree in biophysics (medical physics) and for the M.Sc degree in biophysics

COMPULSORY TOPICS

Mathematics: Measurements. Errors of observatioo. Practice problems in dimensional analysis. Logarithms. Algebraic preliminaries like equations including quadratic and simultaneous equations, imaginary quantities—maxima and minima, surds, partial fractions, permutations and combinations. Elementary trigonometry. Angular velocity. Simple harmonic reaction. Series, especially series. Fuoctions and their graphical representation. Monography. Differentials and differeotial coefficieots. Maxima and minima. Successive differentiations. Integral calculus, thermodyoamics. Differentials and differential coefficients. Maxima and minima. Successive differentiations. Integral calculus. Thermodynamics. Differential equations. Fourier's theorem. Co-ordination of experimental results (e.g. determination of the order of chemical reaction, derivation of empirical formulae connecting more tban two variables, etc.). Biometry and the design of experiments. Use of the slide rule.

GENERAL PHYSIOLOGY

Structure: Methods of ultrastructure research (microscopy including electron microscopy), spectroscopy, diffraction of X-ray and electrons and other biophysical methods (electron spin resonance, electrophoresis, ultracentrifugation, etc.). Principles of molecular structure. Structure of proteins, carbohydrates, lipids, nucleic acids and mineral salts in the body. Structure of membranes.

Function: Utilization of chemical energy including the behaviour of autotrophic bacteria and the mechanism of photosynthesis in addition to the usual mammalian pathways of utilisation of energy. Heat exchanges including poikilothermy and liberation. Transport of water and solutes including the phenomena of osmosis diffusion, membrane permeability, ionic equilibria and bioelectric potentials, tracer fluxes. Extracellular fluids. Absorption from

APPENDIX III

Illustrative list of topics in courses necessary for deeper background in projects undertaken for Ph.D. degree in branches given below

(*a*) **Structural chemistry and diffraction**

Principles of structural inorganic and organic chemistry. Nature of the chemical bond. Quantum mechanics. Rotation of molecules. Nuclear resonance spectra. Vibration of molecule. Anistropic polarisability and the Raman effect. Symmetry. General crystallography. Diffraction of X-rays, electrons and neutrons as analytical method. Structure of polymers. Electrical properties of lamellar systems.

(*b*) **Biophysical chemistry**

Gases, solution. Free energy and chemical equilibrium. Phase equalibria. The conductance of electrolytes, EMF, eqnilibria in electrolytes. Pole-electrolytes. Surface chemistry and colloids. Molecular weights. Macromolecular substances. Rheology of macro-molecular substances. Catalysis. Chelation. Photochemistry. Electron spin resonance spectra. Metabolism and electrons.

(*c*) **Electron microscopy**

Physics of free electrons. Electron as particles. Design and construction of the electron microscope. Preparation of sample for electromicroscopy. Systemic electron histology.

(*d*) **Applied physics and the teaching of biophysics**

Mechanics	: Elasticity of cell materials, viscosity. Surface energy of cells. Tensile strength of bones. Elastomeric elasticity in tissues. Relaxation and creeping properties of tissues. Biophysics of muscular contraction. Aviation biophysics.
Thermodynamics and heat	: Thermodynamics of biochemical reactions. Thermal properties of tissues. Temperature regulation. Hypothermia as an experimental tool.
Acoustics	: Biophysics of the ear.
Light	: Biologic effects of light. Biophysics of vision. Microscopy of various kinds.

Bioluminiscence.
Physics of respiration.
Haemodynamics.
Electrical properties of tissues and its components.
Bioelectrogenesis.
Radioactivity.
Biological effects of radiation.

Decay Scheme. Isotope charts. Nuclear fission. Reactor. Concept of activity, cross sections.

II. *Absorption of radiation.*
Linear absorption coefficient. Half value layer. Mass, electronic and atomic absorption coefficient, scattering of X-rays. Filters.

III. *Measurement of radiation.*
Units, apparatus. Calibrating X-ray generator. Measurement of absorbed dose. Phantoms. Depth dose tables and isodose curves.

IV. Radiation cytology, biochemistry and biophysics.

V. Combination of radiation fields, treatment planning and recording. Radiation therapy.

VI. Radiation dose.

VII. Clinical and experimental use of radioisotopes.

VIII. Radiation protection.

IX. *Apparatus used in radiology and radiotherapy.*
X-ray tubes. Therapy tubes. High energy and teletherapy machines. Cyclotron, Beatron. Electron Synchrotron. Proton Synchrotron. Van de Graf Generator. Resonant transformer Linear accelerator. Nuclear reaction Cobalt 60 units. Caeseum units.

X. X-ray absorption and mass determination in cytology.

XI. Physics of photography.

3. **Pathology and microbiology**

The light microscope and modern methods of microscopy including dark field, stereo, phase, polarising, interference, fluorescence, UV, electron, X-ray and ultrasonic microscopy.

Statistics and experimental design in medical research.

4. **Psychiatry**

(a) Statistics applied to problems in experimental and clinical psychiatry.
(b) Information theory applied to psychology.
(c) Electronics in relation to psychiatry and psychology.

5. **Clinical medicine**

(a) Rheology of blood flow. Cardiodynamics.
(b) Use of radioactive isotope and telemetry in diagnostic procedures.
(c) Fluid and mineral dynamics in shock and dehydration. Artificial kidneys. Mathematical analysis of E.C.G., E.E.G., etc.

6. **Surgery**

(a) Development of prosthesis.

7. **Ophthalmology**

(a) Electroretinography, electrooculography.

intestines. Secretion. Acid-base balance. Excitability of tissues and propagation of impulse in nerves and muscles, including cardiac muscle. Muscle contraction. Ciliary movements. Pigmentary response to light. Bioluminiscence. Vision and hearing.

Synopsis of general biochemistry: General principles of structure and function of enzymes, coenzymes, cofactors.

USES OF RADIOACTIVITY TRACERS

Cytology

Methods of study of intracellular phenomena, general structure of the cell and functions of various intracellular components. Cell division. Cell growth and differentiation. Cytokinesis. Cell responses.

Fixing, dehydrating and embedding of tissues General principles of histochemistry. Freeze drying. Autoradiography.

ELECTRONICS AND INSTRUMENTATIONS

The system concept. The theory of instrument. Order of instruments. Fundamentals of electricity. Aspects of network analysis. Vacuum tubes. Amplifier circuits (various types), oscillator circuits, stimulators. Timebase generators. Power-supply circuits. Detecting and sensing instruments. Recording and read-out devices. Instrumentation schemes. Trouble shooting instruments. Transistors. Computors. Uses of lathe and boring machines. Instruments used in animal experimentation, electronics, X-ray diffraction and biophysical chemistry.

ANALYTIC AND SYNTHETIC CHEMISTRY

Methods of purification and crystallisation. General scheme of systematic identification of organic and inorganic compounds. Functional group analysis. UV and IR spectra. Fluorescence. Emission spectra. Radio-activation analysis. Electron probe microanalysis. Monochromatic X-ray absorption. General principles of stereochemistry. Common procedures of synthetic chemistry. Radioactive labelling instrumental methods of analysis.

APPENDIX V

Some of the numerous items depicting utility of biophysics to chemical departments

1. **Modern trend in molecular biology and biophysics**
2. **X-ray physics**

   I. *Atomic and nuclear physics.*

   (a) Matter. Energy. Particles, atoms, molecules. Radiation.
   (b) Origin of X-rays, characteristic of radiation. White radiation. Angular distribution of X-rays.
   (c) Natural and artificial radioactivity.

   Transformation constant an half life. Atomic processes involved in radioactivity.

Principles of X-ray dosimetry and biologic effects of radiation.

Effects of electric currents on brain tissue.

Electrical stimulation and electrolytic lesion production. Diathermy.

Physical principles governing circulation of blood like hydrostatics and hydrodynamics and aspects of viscosity, vascular elasticity, etc. Energetic of blood flow. Arterial pulse wave velocity. Pressure pulse contours. Implication of wave equation and wave velocity. Determination of external useful X-ray physics.

Post-clinical phase.

Experimental medicine and philosophy of qualitative experimentation.

The null hypothesis. Biostatistics. Computors and Information Theory in medical sciences including psychiatry.

Instrumental methods of analysis.

APPENDIX VI

UNDERGRADUATE COURSE IN BIOPHYSICS

A. **Biophysics (specific pure biophysics topics)**

Concepts of mathematics used in biology

Mechanics applied to the human body, G. forces.
Inertia. Oscillatory phenomena. Ballistocardiography.
Centrifugation.
Fluid Mechanics. Haemodynamics. Use of cardiac catheters.
Surface tension. Osmosis. Diffusion.
Physics of *heat* applied to biological organisms.
Thermodynamics.
Acoustics applied to biology. Ultrasonics.
Applied *optics*. Vision. Bioluminiscence.
Microscopy of various types. Principles of spectro-photometry.
Effects of *electricity*. Passive electrical properties of tissues.
Biological potentials E.C.G., E.E.G. pH, Buffers.
Effects of *magnetic* field on the body.
Radioactivity. Fall out. Effects on biologic organisms. Isotopic Tracers. Radioprotective procedures and substances.

B. **Biophysics in relation to other medical subjects (to be phased with systems or topics by other departments)**

Preclinical phase: Physics of sample preparation for specialised microscopy (phase, polarising, etc.), general histology, histochemistry and electron microscopy. Freeze drying, cell ultrastructure as revealed by electron microscopy and its correlation with the functions of various intracellular components.
Elements of molecular Biology.
General notions of enzymes and their function. Translocation and functions of inorganic ion. BMR and energy transduction and utilisation in the cell.
Muscle physics.
Physics of respiration.
Membrane transport.
Paraclinical phase.
Nature of radiation damage and radiation therapy.
Biophysical methods of study of antigens and viruses.
Nature of drug action and specificity of drugs.
Clinical phase.
Artificial organs like kidney, larynx, cardiac valves, etc. and sensing devices
Monitoring devices used in clinical practices.
Use of radioactive isotopes in diagnosis, therapy and clinical research.

worth while to ponder on a few of these items while reading some literature or before conducting a study. Only then can progress be made in medical education. Many traps are abundantly set up by nature to prevent one from approaching the truth and what the statistical method provides is some kind of a scheme of warnings, detective devices, and safety rules. These do not of themselves create original research but are of immense value in avoiding mistakes in our research and enable us to notice good or bad features of others' work.

Though the logic and reasoning involved in statistical method in medicine is the same as used a hundred years ago, the techniques and the theory have today become more refined and powerful. Probably more developments would be forthcoming as the problems become apparent. There are, for example, many efficient designs for experiments and techniques for analysing the results. But many of the text-books dealing with these subjects are probably full of mathematical formulae and unfamiliar notations, and thus formidable for a medical investigator to read. Therefore, it becomes necessary to elucidate some of these points in a simpler language without too much sacrifice of details. The investigator should also be familiar with the problems of interpretation so that he may state his hypotheses clearly and properly. Here too the text-book language might appear complicated for a lay investigator and therefore the basis for drawing conclusions needs to be explained.

These problems are faced not only by a research worker but by every intelligent teacher who tries to present a subject coherently to his audience. Unless the teacher is familiar with the basic requirements of a good study and is also convinced that a particular argument made in a text-book or in a report is valid and reliable, he will not be able to teach or discuss the subject with the students effectively. Likewise, in medical practice, a practitioner cannot be progressive in his outlook and approach, nor can he find his records useful unless there is an element of scientific method in his day-to-day practice. He may not be able to review critically the claims of innumerable advertisements concerning the latest drugs or forms of therapy nor can he effectively encounter the pressure for substitution of new methods of diagnosis or treatment for older ones.

There is another reason for teaching statistics. Lack of proper understanding of statistical techniques has led to an epidemic of misapplied statistical tests. Often the tests are not only inappropriate but quite unnecessary and applied without any thought. Naturally, the interpretations offered are wrong and misleading. It is extremely difficult to interpret figures when they *relate to some concrete problems. It is equally true that it is extremely easy to do arithmetic.* Herein lies the real difficulty. Averages can be calculated to nineteen places of decimals with astonishing ease. When the job is done it looks very accurate. It is easy but fatal to think that the accuracy of our arithmetic is equivalent to the accuracy of our knowledge about the problem in hand. Many published articles seem to have a negative correlation between the lack of statistical thinking and the soundness of investigation or approach. Often this is due to poorly planned experiments conducted on small samples without careful or reliable measurements. Articles which include terms, such as statistical significance, objective, double-blind and so on with a smattering of symbols such as 'P', 't', etc., seem to have a greater acceptance in the journals than others without such jargon, thus providing ample justification for statements, such as "lies, damned lies and statistics," "you cannot be a good biochemist and biostatisti-

THE VALUE OF STATISTICS IN MEDICAL EDUCATION

DR. P. S. S. SUNDER RAO

Senior Lecturer in Biostatistics, Christian Medical College, Vellore

"IS the application of the numerical method to the subject-matter of medicine a trivial and time-wasting ingenuity as some hold, or is it an important stage in the development of our art, as others proclaim?" (*Lancet*, 1 : 985, 1921).

There are many definitions of the word "statistics." Some define statistics as the science and art of collecting data, their analyses and interpretation. Another definition states that statistics deals with elucidation of quantitative data affected by multiplicity of causes. It is both a science and an art of dealing with variation. Medical statistics is at times understood as the principles of quantitative medicine. The actual role of statistics in medical education is still not completely determined; but what impresses one most is the increased use of statistical method in almost all phases of medicine. One can hardly pick up a journal and go through it without coming across the usage of a few basic statistical concepts. It is noticed, however, that this use is made without completely understanding the concepts and that the knowledge about this particular science is rather hazy. Several instances of misuse of statistics are observed, some of which are based on ignorance and some on a little knowledge. It is said that the magic of numbers brings about a suspension of commonsense but should a person take a second look at these numbers it will make him view them in the proper perspective. This latter is essentially what is vitally needed in all phases of medical education today.

The Flow-chart shown in Appendix 1 represents the role played by biostatistics in the various phases of medical education. We notice a circle of developments which continues all the time. We must realise that research assists proper teaching and teaching leads itself to further research while medical practice proceeds concurrently with these developments. A knowledge of statistical method is essential in every discipline of medical education. Any research, fundamental or applied, deals with measurements and/or counting and arguments made from a sample to a larger group from which this sample arises. Various kinds of tables and diagrams are drawn in this process, depicting responses and other associations. As research continues, more complicated phenomena are dealt with. In any particular field of medicine, the body of knowledge that is available is due to prior observations. With additional information the body of knowledge changes. Now, where does one draw the line between what is authentic and what is not, between what is authoritative and what is not? How does one interpret the present findings in the light of previous outcomes? Is there a way of measuring the reliability and validity in any one experiment? What are the problems and biases involved in the experiment? What are the "jokers" inherent in any associations or relationships, and what about certain vital indices that are missing from the reports? These are questions which are legitimate in any critical review. Certainly, not all of these problems can be solved in any situation, but it is undoubtedly

APPENDIX I

COURSE CONTENT AND ALLOTMENT OF TIME

Content	*No. of hours for Theory*	*Practical*
1. Descriptive statistics		
(a) Introduction—aim and scope of biostatistical methods	2	—
(b) Collection of data—preliminary ideas	2	—
(c) Presentation of data—tabulation—diagrams—graphs	3	4
(d) Measures of central tendency and dispersion	4	4
(e) Concepts of correlation and regression	2	2
2. Statistical inference		
(a) Elements of probability	2	2
(b) Elements of sampling	2	2
(c) Statistical estimation	2	2
(d) Tests of significance	3	4
(e) Testing hypotheses	2	2
3. Some special problems in biostatistics		
(a) Design of clinical trials	2	2
(b) Problems of field studies	2	2
(c) Vital and health statistics	3	2
(d) Hospital statistics	2	2
(e) Misuses of statistics	2	—
	35	30

cian" and others. These comments again denote a confusion between statistical arithmetic and statistical thinking.

Thus, a major objective in teaching biostatistics should be to encourage statistical thinking and provide sufficient caution while using statistical tests from some statistical cook-book. It is true that the lectures or laboratory sessions in statistics by themselves would not make an investigator sufficiently trained without some personal guidance and experience. Nevertheless, statistics should be an important basic discipline in the medical curriculum so that every student can

(a) understand the principles of handling and presentation of data;
(b) learn a few common concepts used in statistical theory such as the measures of central tendency, dispersion, correlation, probability, etc. and be familiar with the usual terminology used in statistics;
(c) acquire an ability to read or review critically any studies or literature pertaining to his subject;
(d) regulate thinking through the major problems and biases that might occur in the course of his own research or study; and
(e) obtain an insight into the arguments and implications involved in statistical inference.

To achieve these objectives, every postgraduate student in medicine should undergo a course of at least 35 one-hour lectures and 15 two-hour practical classes. The course should preferably be spread over a 6-month period. An outline of the course is shown in Appendix II. There should be one compulsory final examination in the subject.

One of the problems in teaching statistics as a subject in medical colleges has been the lack of interest in the subject. First, this may be due to an emotional resistance on the part of the students towards anything smacking of mathematics because they consider statistics as a branch of mathematics. This view is not correct since statistics is not a branch of mathematics but like any other science uses the tools made by the mathematicians. In teaching statistics it would be a mistake to emphasise the technical part more than the conceptual part. Statistical techniques are no doubt an important part of modern experimentation but of secondary importance to a medical student. It is statistical thinking that is vital; the techniques are as useless as lumber, in fact dangerous, if applied without proper thought. Secondly, good teachers of medical statistics may not be available. A good teacher would be one who has a medical background with practical experience in the statistical method or a statistician who has had practical experience in medical research. A separate department of biostatistics which provides service to the whole institution could be an ideal set-up for the teaching of biostatistics. It seems imperative at this stage of modern development in medicine that efforts should be made to inculcate in the student early in his career the basic ideas of methodology in research. It is only in this way that advance could be made in medicine in the shortest possible time. Every amenity should be provided in a postgraduate medical institution to give the student this opportunity whatever may be the vocation he would follow—a teacher, a research worker or a medical practitioner.

APPENDIX I

COURSE CONTENT AND ALLOTMENT OF TIME

Content	*No. of hours for* *Theory*	*Practical*
1. *Descriptive statistics*		
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(*b*) Collection of data—preliminary ideas	2	—
(*c*) Presentation of data—tabulation—diagrams—graphs	3	4
(*d*) Measures of central tendency and dispersion	4	4
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(*a*) Design of clinical trials	2	2
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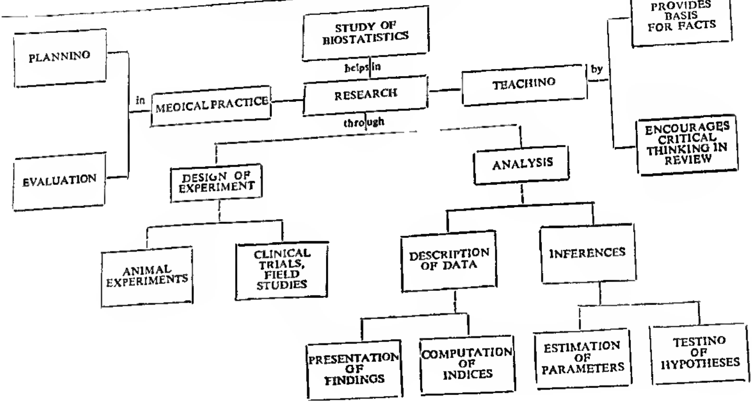
(*c*) Vital and health statistics	3	2
(*d*) Hospital statistics	2	2
(*e*) Misuses of statistics	2	—
	35	30

APPENDIX II

ROLE OF BIOSTATISTICS IN MEDICAL EDUCATION



REPORT OF THE SUB-COMMITTEE ON BIOCHEMISTRY, BIOPHYSICS AND BIOSTATISTICS

THE following were present:

1. Dr. G. P. Talwar, Chairman, New Delhi.
2. Dr. N. K. Sarkar (Calcutta).
3. Dr. R. K. Mishra (New Delhi).
4. Dr. P. S. S. Sunder Rao (Vellore).
5. Dr. T. A. V. Subramanian (New Delhi).
6. Dr. R. Mazumdar (New Delhi).
7. Dr. (Mrs.) S. Rao (Bombay).
8. Dr. (Group Capt) Dutta (Bangalore).
9. Dr. A. P. Kenny (WHO, Baroda).
10. Dr. (Mrs.) T. T. Antony (New Delhi).
11. Dr. R. P. Khan (New Delhi).
12. Dr. A. N. Nadekar (New Delhi).
13. Dr. (Mrs.) U. Bhargava (New Delhi).
14. Dr. S. V. Pande (New Delhi).

1. The group felt that in several colleges the departments of biochemistry, biophysics and biostatistics still continue to hold subordinate positions. This framework is incompatible with a free and healthy development of these subjects. It is necessary to constitute separate and independent departments without any further delay in the interest of promotion of post-graduate education in these subjects.

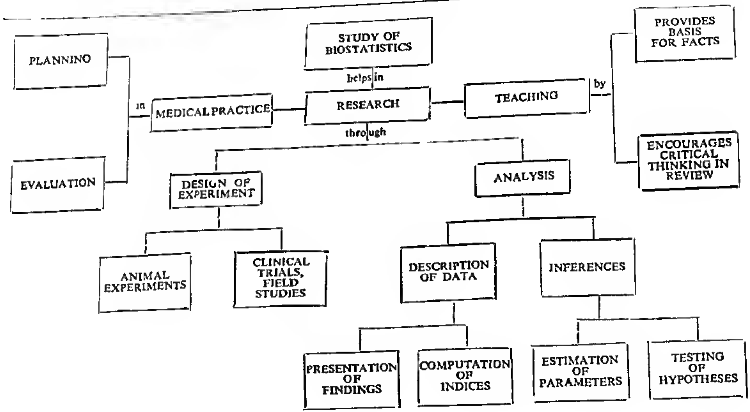
2. The group strongly recommended the eligibility of non-medical scientists to *all* posts including that of the head of the department in these subjects. The criteria should be the ability of the candidate as biochemist, biophysicist or biostatistician and not the first graduate degree. The existing rules and regulations are acting as barriers to the development of postgraduate training in these subjects, by not utilising the services of highly qualified non-medical scientists for teaching programmes in these subjects.

3. Biochemistry and biophysics are experimental sciences. Therefore, it is in an atmosphere of investigation and research that sound postgraduate training in these subjects can be given.

4. It follows that if these aims have to be fulfilled, active research groups have to be organised in the department before postgraduate degrees and training programmes are instituted in a college. In contrast to many other fields of national planning, it is not the *number* but the *quality* which is important in postgraduate education programmes.

APPENDIX II

ROLE OF BIOSTATISTICS IN MEDICAL EDUCATION



ASSESSMENT

1. The group recommended the introduction of a "teaching exercise" as a part of the examinations for the postgraduate degree in these subjects. This provision would motivate the student to develop aptitude for teaching and would also permit a more comprehensive assessment of his overall abilities and proficiency.

2. In view of the widely varying standards, the group felt that in course of time a National examination may be instituted for M.D. and M.Sc., to ensure adequate standards.

3. The standard of the student entering for the postgraduate degree is, at the moment, not satisfactory. Their background in basic sciences, such as chemistry, physics and mathematics, needs to be improved. In this respect the group felt that the introduction of B.Sc. (Hons.) course in basic medical sciences would help in preparing better students to undertake postgraduate courses. The graduates at this stage would be permitted to either continue the clinical phase of training or undertake postgraduate studies in any basic subject.

CURRICULUM

4. The outline of the suggested *syllabus** for M.D. in biochemistry and M.D. in biophysics has been included in the volume published for the Conference. This may serve as a base line for the elaboration of the syllabi and curricula in various colleges.

A suggested *strength of staff* for postgraduate departments is included in Appendix I. This suggestion is a broad outline. The exact strength will depend on the duties that the department has to perform.

A suggestion about the *essential equipment* for a postgraduate department in biochemistry is given in Appendix II. The list of equipment for biophysics has already been published in the Conference volume.

APPENDIX I

Staff Requirements for a Postgraduate Department in Biochemistry

(The requirements for biophysics have been given in the Conference volume.)

(i) Professor and Head of the Department.

(ii) Two posts of Associate Professors.
One in biochemistry and one in biophysics.

These posts may be filled ordinarily from amongst the assistant professors who have shown promise in their respective fields. Additional posts may be created in tune with the demands and necessity for the promotion of Assistant Professors.

(iii) Six posts of Assistant Professors. The Assistant Professors may be chosen on the basis of their background and past training to represent and to develop sub-specialities and areas of special interest to the department.

* Appendix III.

STAFF REQUIREMENTS

5. A postgraduate department should have a staff of high academic and intellectual calibre. The criteria for the selection of staff for a postgraduate department should be:

(a) A postgraduate research degree or in *exceptional* cases a brilliant record of research.
(b) Independent research contribution.
(c) Originality of thought and capacity for guiding a research team.
(d) Experience of a certain number of years is always desirable but insistence on a number of years of experience *without* any productive record is an obsolete criterion.

6. The existing methods of selection of staff need re-orientation. The merit of a postgraduate teacher is to be gauged by his contributions, by his standing in the profession and by his proven record. The teaching posts may be filled up by invitation after due reference to a panel of experts instead of by the prevailing system of advertisements and interviews.

7. The size of the staff should be commensurate with the overall duties of the department and should be adequate to leave sufficient time to each member of the staff for research work (see Appendix I).

8. International exchange, collaboration and participation in research and training activities at all levels should be encouraged.

EQUIPMENT AND CHEMICALS

9. Sufficient equipment should be provided to facilitate the research programmes of the department (see Appendix II).

10. In view of the non-availability of rare chemicals and all radio-active compounds in the country there should be an allocation of foreign exchange equivalent to Rs. 5,000 at least to each postgraduate department per year to enable the import of essential items. Some provision may also be made for obtaining spares and replacement parts for existing equipment.

11. Most of the rare chemicals are labile entities and get inactivated during storage at ordinary temperatures. The existing formalities for clearance are lengthy and cumbersome. The group was strongly of the opinion that steps may be taken by the Ministry of Health to secure permission from the Government of India for spot release of such items imported by teaching institutions. It may be mentioned that similar provision already exists for the release of radioactive compounds.

POSTGRADUATE DEGREES

12. The postgraduate training is visualised at two levels:

1. M.D. and M.Sc.
2. Ph.D.

The former envisages advanced academic training in the subject, while the latter is primarily a research degree.

(iv) Three posts of Chemists—one each in Organic, Physical and Inorganic Chemistry.
(v) Two to three floating posts of Research Officers in the grade of J.R.O. and S.R.O. These posts will be instituted to provide continuity to candidates finishing their Ph D and desirous of pursuing further the problem of their research.
(vi) One post of Research Officer (Applied Mathematics and Biostalistics).
(vii) Demonstrators: number depending on the size of the class of undergraduates. Recommended proportion is 1 demonstrator per 20-25 students.
(viii) Technicians, Lab. Assistants and Lab. Attendants: according to the size and activities of the department. For an active department with fairly heavy responsibilities the suggested staff is:

2 Technical Assistants
6 Technicians
4 Lab. Assistants
3 Lab. Attendants
1 Animal Care-taker
1 Animal House Attendant

(ix) Glass Blower—1. For repair and fabrication of equipment.
(x) One Technical Assistant (Electronics).
(xi) One Technical Assistant (Electrical and Refrigeration).

APPENDIX II

List of Equipment for a Postgraduate Department in Biochemistry

(The list for biophysics has been given in the Conference volume)

1. Essential equipment

It will vary with the research interests of the department. Most departments will, however, require:

(i) One spectrophotometer u. v. and visible range.
(ii) Two, three (or more), depending on size and curriculum of undergraduate class, photo colorimeters—Klett Summerson, Coleman, Hilger (which is now locally manufactured) or any other make—to lessen the load on spectrophotometer and to accommodate under graduate teaching.
(iii) Centrifuges: about 3, including one refrigerated centrifuge.
(vi) Balances: one analytical type; one pan balance for weighing of larger samples; one microbalance. These may be single pan, automatic weighing types. Simple pan balances.
(v) Distillation apparatus for preparing distilled water.
(vi) A demineraliser for obtaining ion-free water for research work.
(vii) A metabolic shaker—Dubanoff type.

It is necessary for a department to progress by stages. It is also necessary that every department should strive to develop a few very specialised techniques which should be perfected by successive batches of staff and students. These departments instead of diffusing their activities thus become centres for the learning of such techniques. Gradually, more and more techniques should be added. The advantage of this will be that anybody who comes to learn these from these centres can be taught effectively. Unfortunately, these conditions can hardly be met with in most institutions now.

The teaching programme in pharmacology, though organised in most medical colleges, still leaves many things to be desired. It may either not be fully adequate or the training in allied subjects like physiology, biochemistry and pharmaceutical chemistry may not be up to the mark because of paucity of facilities. Personally, I do not favour a very elaborate teaching programme amounting to spoon-feeding. Adequate facilities should, no doubt, be provided, but the initiative for thinking, self-study and acquiring knowledge should come from the students themselves. Some organised teaching is necessary, because we do not always get the best postgraduate students in the basic departments.

Another important prerequisite for good postgraduate education is the creation of an inspiring atmosphere for learning and healthy intellectual pursuit. An educational institution should become a temple of learning as is the case in Oxford, Cambridge, Harvard and in so many other universities. We have in most cases neither teachers, who can inspire our students, nor a harmoniously blended atmosphere. Interference from outside and inter-departmental conflicts make the atmosphere dismal and dull.

All these make us think of the future—our goal and how to achieve that. There is one fundamental point that we should not fail to understand, i.e. the importance of a sound undergraduate training programme. If postgraduate education is the superstructure, undergraduate education is the foundation which, if lacking in strength, will make the superstructure liable to crumble. These two types of education have a reciprocal relationship.

The deficiencies existing in the undergraduate training should be rapidly remedied after a student is enrolled for postgraduate studies. A separate examination to test their knowledge of allied subjects like physiology, biochemistry, biophysics, etc. is not very necessary, though every effort should be made to test the candidate in the above subjects. All this, as well as participation in seminars and discussions, reviewing of articles and the preliminary practical work, should be done in the first year. During the second year, the candidate should learn specialised techniques and should complete his thesis work. During the third year, he should make an intensive study of all aspects of pharmacology, including bioassay and biostatistics and should take active part in teaching, seminars and discussions.

For enabling the student to do all this, the department has to be dynamic in its outlook and should have vigorous research activity to its credit. Regular supervision of a candidate's work and its quality should be ensured. Besides his own work, the candidate should be encouraged to take interest in the works done on different lines by other members of the department.

A postgraduate student working all along in one institution is likely to have a rather myopic vision. Inter-institutional contacts should, therefore, be established. There should be

ORGANISATIONAL PATTERN OF POSTGRADUATE TEACHING PROGRAMME IN PHARMACOLOGY—PRESENT AND FUTURE

DR. B. C. BOSE, M.D., D.SC., F.A.M.S.

THE postgraduate education in pharmacology is of recent growth. From an unorganised state, it has now taken a mueh more concrete and elaborate shape. It was during the post-war period that eonsiderable thought was given to the system of postgraduate education, particularly in the U.S.A., and a detailed comprehensive teachiog programme was ehalked out, which not only embraced the teaehing of the speciality subjeet, but embraced also allied subjects. Thus, the training for Pb.D. degree in universities like Harvard is multifaceted and prepares the candidate to become versatile.

Most medieal colleges in India before 1940 did not consider postgraduate training in pharmacology within their scope. This outlook has undergone a drastie change, particularly in the post-Independence period. This bas been due to better planning and intermixing of ideas from foreign countries, so mueh so that most of the new colleges are planned from the outset to impart postgraduate education which has both good and bad aspects. Good, beeause it is a positive step towards the production of a larger number of postgraduates to man the ever-increasing number of new medical eolleges. Bad, because rapid expansion without giving sufficient time for consolidation can lead to faulty working.

For proper development, a college should have, first, adequate routine and specialised laboratory facilities, with a fairly complete set of instruments; and, secondly, adequate number of qualified and experienced staff who should teach and pay attention to speeial fields of researeh work. They should be allowed to work undisturbed for a reasonable length of time in one institution.

Let us, therefore, take stock of our assets and liabilities at present so as to plan for future improvement. Most institutions possess the above requisites but what they lack is a coherent programme for systematie research and planned development. The reeruitment of staff and working conditions leave much to be desired. Instability of staff is detrimental to the interest of the institution. Pharmacological work of a high calibre is possible only if good team work with well-trained chemists exists. Every progressive pharmacology department should have a very well-developed chemistry section which should specialise in biochemistry, pharmaceutical chemistry and also do synthetic work.

A postgraduate department must develop special fields of interest and should pursue investigations and research in these directions in a sustained manner.

The staff should be adequately paid so that they can give their undivided attention to their assignments. Good work should be individually rewarded. There should be ample scope for local promotion of deserving individuals. This will prevent dislocation of work due to frequent transfers. Rapid increase in the number of medical colleges and the lack of foresight shown by the authorities have contributed greatly to the creation of a chaotie state.

AIMS AND CONTENT OF THE POSTGRADUATE CURRICULUM IN PHARMACOLOGY

DR. R. B. ARORA

I. NOMENCLATURE OF DEGREES AND PERIOD OF TRAINING

I feel that the degree of M.D. should be the first degree to be given to a medical pharmacologist three years after his passing the M.B.B.S. and the degree of Ph.D. two years after M.D. I shall deal in some detail with the M.D. degree—the period of training, methods of examination, etc. In this connection, I may say that the general trend followed by the All-India Institute of Medical Sciences is that an M.D. course in pharmacology should include concurrent clinical training. Since the emphasis at present is on clinical pharmacology as an important discipline, it stands to reason that there should be compulsory attendance in clinical subjects. Thus, for example, it is not unwise to suggest that the postgraduates should spend 140 hours with the departments of medicine, anaesthesiology, paediatrics, ophthalmology, dermatology, venereology and experimental surgery. Of course, 70 per cent of this time will be spent in the department of medicine. In a country like ours, where so many drugs are lying unscreened for want of clinical pharmacology and where ten to twelve crores every year are being spent on foreign exchange, it is absolutely essential that this discipline should be developed in all the medical colleges.

Regarding the non-medical graduates, I. feel that they may be given a degree of M.Sc. after three years of training in pharmacology. The degree of Ph.D. and D.Sc. should be open to both medical and non-medical graduates. The period of training for a whole-time postgraduate should be two years, if he has done a year of house job or one year in the department of pharmacology after his M.B.B.S. Further, in the case of people engaged in research enquiries or in the department, this period may be increased to three years. Thus, an M.B.B.S., who is a whole-time postgraduate, gets a degree three years after his first medical qualification and a person who is employed as a demonstrator or a junior research officer gets it four years after his M.B.B.S.

This period may appear a little too long to some but, in support of this contention, I have to say that I envisage the course for M.D. in pharmacology to consist essentially of:

I. Training in pharmacology, pharmaco-therapeutics and toxicology, including experimental pharmacology and chemical pharmacology.
II. Research and teaching methodology in pharmacology.
III. Chemical sciences as applied to pharmacology.
IV. Attendance at an integrated course of lectures and demonstrations.

Therefore, it becomes necessary for the postgraduates to spend this period. Moreover, I envisage four papers: Papers I and II (pharmacology and toxicology including bio-assay,

more extension lectures delivered by experts from other institutions, and study trips from one institution to another should be organised. The candidates should be made to attend some conferences. Though a costly investment, this is likely to lead to greater dividends. Education itself is a good investment, and any means to acquire it should be wholeheartedly encouraged. If this is not done, the quality of postgraduates will remain low and they will be prone to become static soon after they have obtained their degrees.

From what has been stated earlier, the following important points deserve special consideration:

1. Proper selection of postgraduate students.
2. Essentiality of basic training in allied subjects, considering the present standard of our students.
3. The organisational set-up in each postgraduate department envisaging specialised units; appropriate organisation with regular research. For this, trained staff should not be frequently changed and they should be able to get departmental and institutional promotion.
4. Organisation of an active training programme, involving full-time working of the staff.
5. Organisation of research projects in a practical manner, bearing in mind existing technical facilities and avoiding lopsided development.
6. Acquisition of the latest techniques, and correct orientation, enabling the candidates to do precision work on quantitative basis.
7. Avoiding over-teaching which may kill all initiative and independent thinking.

We are entering the field of research later than many other countries and we may have the natural tendency of following in the footsteps of others in the selection of the subject without having the technological and other prerequisites. It may not be a bad thing to think of our own problems in this country, fields where others are not working, and to do work on these untreaded spheres, which may be of greater benefit to the country and to the world than copying others' work slavishly.

The path is circuitous and we must work carefully, thinking and planning every step. With the enthusiasm created in our workers for postgraduate training and research, it should not be difficult to achieve our goal, if we move cautiously with correct objectives and determination.

(i) Lack of fixation of the minimum number of admissions per year in clinical subjects which attract most of the students for postgraduation.

(ii) Lack of special attraction in pre-clinical studies due to inadequate salary and inadequate compensation for the non-practising teachers.

In actual practice there is very little to choose, because half the number of posts of the junior cadre in the non-clinical departments are lying vacant, and persons with M.D. or M.S. degrees are being quickly promoted to the posts of lecturers, readers, etc.

If some rules are to be framed for the selection of candidates, the following may be considered:

(*a*) Students who have passed all their examinations in the first attempt, securing an aggregate percentage of not less than 55 per cent in all the university examinations.

(*b*) Students with an occasional failure (1 or max. 2) may be considered only if they have not failed in the subject of the speciality (pharmacology) and secured 60 per cent marks in the subject.

(*c*) Students who have shown aptitude for techniques, power of observation and clarity in expression during the first three months of the training.

(*d*) The candidate who has decided to take this subject of speciality for his future career.

For the M.Sc. degree in pharmacology, I feel we should admit a student with a B.Sc. (Pharmacology) or B.Sc. (Basic Medical Sciences) or B. Pharm. B.V.Sc. degree. The B.Sc.'s should undergo a one and a half years' training in anatomy, physiology and biochemistry and then spend two years in the department of pharmacology along with undergraduates and postgraduates. The B. Pharm.'s should go in for a three-year training, devoting one year to anatomy and two years to pharmacology, whereas the B.V.Sc.'s should spend one year in biochemistry and two years in pharmacology.

III. METHOD OF EXAMINATION

I have already dealt in some detail with the M. D. examination. Regarding Ph D. and D Sc., I feel that both a non-medical graduate having a degree of M.Sc. and a medical graduate with a degree of M.D., should be allowed to appear for Ph.D. and D.Sc. examinations. The period required for Ph D. should be at least two years after M.D. and for D.Sc. two years after Ph.D. I may add that there seems to be a lack of realisation that a Ph.D. or D.Sc. thesis should be of an altogether different type from the M.D. thesis. This I say from my experience of examining Ph.D. theses of various universities. The former should be a critical study in a restricted field of investigation and should contain a review of relevant literature. This is often not the case at present and a correct lead has to be given in this direction.

Finally, I feel, I have to justify my suggesting that the M.D. degree should be awarded to medical graduates and the M.Sc. degree to non-medical graduates. I have a feeling that there is an acute dearth of trained personnel in pharmacology in India and non-medical pharmacologists can fill in this gap specially in the training of the chemical and biochemical aspects of pharmacology to both undergraduates and postgraduates and helping in the preparation of the theses of the postgraduates. However, I am not in favour of their being appointed as profes-

experimental pharmacology and history of pharmacology) on pharmacological aspects; Paper III (basic sciences as applied to pharmacology, i.e. (*i*) biochemical pharmacology, including neuro-hormones, local hormones and enzymes connected with drug action, (*ii*) chemical pharmacology with special reference to structure activity relationship, (*iii*) physiology with special reference to vitamins, hormones, minerals, autonomic nervous system and carbohydrate, protein, fat, and calcium metabolism); Paper IV (clinical sciences as applied to pharmacology to familiarise the student with (*i*) matters similar to the ones that are published in journal of clinical pharmacology and therapeutics, (*ii*) chemotherapy with special reference to the use of these drugs in clinical practice, (*iii*) applied pharmacology, (*iv*) drug trials, placebos, etc. and (*v*) knowledge gained by ward rounds and instructions by clinical professors).

The practicals and viva voce to include:

I. Practicals

(*i*) Identification of an unknown drug on isolated tissue or an experiment in chemical pharmacology.

(*ii*) Biological standardization of a drug.

(*iii*) Demonstration of action of drugs on anaesthetised animals or an experiment from the thesis submitted by the candidate.

II. Research Colloquium

Research colloquium will be an open session in which visitors will be permitted. A thirty-minute talk will be given by the candidate reviewing the subject connected with his thesis. This will be followed by a 15 to 20 minutes discussion in which the candidate would be expected to answer questions put by the examiners or by any members from the audience.

III. Viva Voce Examination

I think an integrated course of demonstrations and lectures should also be given to the post-graduates. This should consist of a course in the history of medicine, breeding and maintenance of experimental animals, anaesthetics for laboratory, animals, common experimental surgical procedures, kymographic techniques in acute experiments, principles of medical electronics, perfusion techniques, method of drug administration, log dose response curve, use of colorimeter, spectrophotometer, pH meter, and flame photometer, electrophoresis and paper and column chromatography, knowledge about isotopes, frozen and paraffin sections, and staining technique, histochemical technique, study of cell, tissue culture, experimental production of pathological state and genetics. It may be of interest to know that we are following this course of AIMS.

I have dealt with the above portion of the course for M.D. which is outside the scope of my discussion, but such a discussion becomes necessary if we want to justify the period of training as mentioned above.

II. SELECTION OF STUDENTS

Regarding the criteria for selection of students, I may say that we are dealing here with a difficult problem because of the non-availability of a sufficient number of students for basic subjects. This is partly due to:

control laboratories, ayurvedic colleges and drug testing laboratories need competent pharmacologists."

Being associated with the two national drug research laboratories (Central Drug Research Institute and I.E.M. & B.) in the capacity of member of their governing bodies, with Pharmaceuticals and Drugs Committee, C.S.I.R., and with Pharmacology Committee of I.C.M.R., I feel, I have some idea of the vital problems concerning drug research in the country, the role of various national laboratories and also of the research finances and foreign exchange difficulties.

I have a feeling that the methodology of the development of a product (a new drug), which is ani mportant part of postgraduate pharmacology training, is only possible in a teaching-cum-research medical institute having facilities for clinical pharmacology. I, therefore, suggest that this working group may propose the establishment of an Institute of Drug Research with special reference to Pharmacology and Toxicology for meeting the needs of the country for trained pharmacologists.

sors or additional professors in the medical colleges. In a country like India, we need the development of clinical pharmacology more than any other branch of pharmacology, specially when there are no chairs in therapeutics. I further feel that the teachers of pharmacology, if they really want to do justice to the subject of pharmacotherapeutics, should be given beds in the hospital and the system which was being followed earlier all over the country should be resumed. The fact that the heads of the departments of pharmacology are as good, if not better, clinicians than the regular professors of medicine, supports this viewpoint. If we fill all the posts with non-medical pharmacologists, the very purpose of integrating pharmacology with basic sciences on one hand, and with clinical sciences on the other, will be defeated. I feel that the non-medical pharmacologists should be given such designations as junior research officers, senior research officers, research associates and even readers and professors of chemical pharmacology. If the above training programme, criteria for the selection of students and methods of examination, which I have proposed, are agreed upon, then we must be very clear in our minds about the designations. If we relax the rules today, on the plea that there are some bright individuals, it will mean the ruin of the subject and its future.

In conclusion, I may add that there is a real and pressing need for a large number of trained pharmacologists in our country. The pharmacologists are indeed not only wanted for the medical colleges, but also for the pharmaceutical, veterinary and ayurvedic colleges as also for pharmaceutical manufacturing houses and drug research institutes which are developed or are to be developed in the country. In addition, they are also needed in the various drug-testing laboratories envisaged in the Fourth Plan. Therefore, the non-medical pharmacologists need not get upset and press their claims for readerships and professorships in medical colleges, because they will find better scope where they are better suited.

I may say that it is high time that we developed an institute for drug research with special reference to pharmacology and toxicology to meet the needs of the country. One should be convinced of the above contention if one reads the third reviewing committee's report of the C.S.I.R., 1964, which says on page 39:

"India has a rich tradition in the use of vegetable drugs and herbs for amelioration of human disease through the Sidha, Ayurvedic and Unani systems of medicine. Chemical and Pharmacological research on Indian medical plants is being carried out at a number of Indian Universities and C.S.I.R. laboratories. However, major investigations have been carried out in countries abroad and foreign pharmaceutical concerns have introduced active principles from some of the Indian drugs into the pharmaceutical field.

"In this connection, it may be mentioned that India is one of the few countries where a major part of drugs used therapeutically are imported in spite of the fact that the drug industries, manufacturing firms, universities (chemistry departments), national institutes like Central Drug Research Institute with their pilot plants are making a large number of synthetic drugs. The bottleneck lies, however, in non-availability of competent pharmacologists who would conduct the screening of new drugs. The junior posts in practically all the 80 medical colleges and practically every senior post in 16 pharmacy institutes, and 15 veterinary colleges in the country are lying vacant. In addition, drug concerns, drug research institutes, drug

in that aspect only. Postgraduates trained in that department will be highly trained in the particular branch of the subject, which will be learnt only in an elementary fashion by postgraduates trained in other departments. This, of course, is understandable, and a uniform standard of basic training for postgraduates, on the basis of which specialised training can be acquired individually by different departments in more than one specific aspect, is needed.

Irrespective of the specialised work done by the department, certain basic and broad-based training in the subject in all its aspects should be given to the postgraduates. Most of the postgraduates will become teachers in medical colleges and, for teaching undergraduates, a sound knowledge of the subject as a whole is essential. The basic training should comprise comprehensive theoretical knowledge gained from standard text-books and monograms on recent advances in the subject. "Year Book" in pharmacology, monograms on drug research, medical chemistry, and pharmacological reviews give an excellent coverage on current topics. They also provide very useful cross references. The reading should also include important journals in the subject published in the last three to five years. To this should be added a background of historical developments, which will give a proper perspective of the subject. The subject of pharmacology is so intimately connected with other related subjects that some reading in them is also essential. This should include reading of a good text-book in physiology and of physiological reviews on the basic side. A good modern text-book of medicine should form a companion to the text-book of pharmacology. Most of the drugs used today are synthetic compounds, hence a good training in medicinal chemistry becomes essential. For planning any research work and for evaluating the results obtained from a research project, a working knowledge of medical statistics is a must.

Laboratory work should include a general knowledge of common experimental techniques, and the use of some of the apparatus used in biochemical investigations like colorimeter, spectrophotometer, pH meter, flame photometer, etc. The work for dissertation will aim at a number of objectives. It will teach the student how to plan investigations. This would necessitate looking up the literature on the subject, use of library facilities, collection of data and review of the work done in that particular problem. This will develop his critical faculty and help him to analyse the published work. He would be able to evaluate what has been done and decide what remains to be done. Then comes the planning of the experiment, statistical design, and carrying out the actual experiments. This will train him to formulate specialised methods in experimental pharmacology. Periodic discussions about his work with his colleagues will train the student to understand that it is necessary to be flexible and critical in his outlook. At the end of the project, when the work is completed, he will have to evaluate the results and discuss the implications of his results. The writing of the thesis will also train him in the art of medical writing in which unfortunately many of us are sadly deficient.

Weekly departmental seminars and meetings for review of current journals will help the postgraduates keep abreast of the modern developments in this subject.

In view of the fact that the subject of pharmacology is becoming more and more 'clinical', and human pharmacology is being accepted as an important branch of the subject, some train-

BASIC AND SPECIFIC REQUIREMENTS OF POSTGRADUATE TRAINING IN PHARMACOLOGY

DR. U. K. SHETH, M.D., B.SC., F.C.P.S.

WHILE discussing the basic and specific requirements of training postgraduates in pharmacology it is necessary to define at the outset what we exactly mean by postgraduate training in pharmacology. The definition is necessary because the postgraduate studies in pharmacology in our country at most places mean training of a medical graduate in pharmacology. This has been termed by some as training of a medical pharmacologist. The essential basic training of these students is in general medicine, and during the postgraduate training in pharmacology, he gets trained in classical pharmacology. The usual career of these students is that of teacher in medical colleges. They teach both undergraduate and postgraduate students and sometimes they do some research work, usually in the field of classical pharmacology and in some places in clinical trials of drugs. These two aspects have assumed some importance in the last decade only.

In the last few years there has been increased activity in the field of drug research in medical colleges and specially in research institutes. Rapid advancement in pharmaceutical industries in the country has led to increased need for trained pharmacologists. These developments have created the problem of training pharmacologists specifically for research and drug industries. This problem is, however, complicated and is being dealt with in another paper.

Medical graduates at present can qualify for either M.Sc. or M.D. in pharmacology after attending a postgraduate course extending over two to three years. The qualifying examination includes theory papers, practicals and viva voce. The M.D. course includes one paper in general medicine. Before being allowed to appear for the M.Sc. or M.D. examination, the candidates have to submit a dissertation on some research carried out by them during the postgraduate studies. After M.Sc. or M.D., the postgraduates can take up research work for a period of one year or more and submit a thesis for the Ph.D. examination.

Many of us who have been training postgraduates in pharmacology have felt that some sort of uniform organised training for postgraduates is necessary for maintaining comparable standards all over the country. This has become an urgent problem in view of the fact that the subject of pharmacology has seen unprecedented developments of late, leading to highly specialised subdivisions like biochemical pharmacology, psychopharmacology, cardiovascular pharmacology, molecular pharmacology and neuropharmacology, etc. It is impossible for a postgraduate student to study in detail all these specialised aspects of the subject in three years. It is equally impossible for a single department to impart training and set up experimental methods in all the branches of the subject because a particular department will be more interested in some one aspect of the subject and will have facilities for advanced training

some of these non-medical postgraduates can profitably engage in research work besides partaking in the teaching of students. This is commonly done in countries like the U.S.A. where, except for the head of the department, a large percentage of the teaching staff consists of non-medical pharmacologists. These non-medical postgraduates will be primarily interested in pharmacology, as there is no possibility of their practising clinical medicine. Thus, it will be possible to build up a suitable team of research workers who will be able to carry out long-term research projects.

Since in the ultimate analysis pharmacology is an applied subject, objections to such a training programme for non-medical graduates have been made on the grounds that it becomes difficult to give a medical orientation to these science graduates. This difficulty is not so unsurmountable as it has been made to look. A little readjustment in teaching schedules in medical colleges can help us to overcome this difficulty. I should like to suggest that we should institute a special course of B.Sc. for this purpose. Students who have qualified with Inter-science biology group can be admitted to this course. The course should extend over a period of two years so as to conform to the B.Sc. course in the science faculty. The curriculum should consist of anatomy, physiology, biochemistry, elements of statistics, training in care and breeding of animals, planning and maintenance of animal house, and a course in the use of instruments and glassware used in medical research. The details in anatomy and physiology can be reduced and only the basic facts about this subject should be taught. A B.Sc. who has obtained the above training has two courses open to him for his future career. He can be an efficient technician in research institutions, in medical colleges or in the pharmaceutical industry, or he can undergo further postgraduate training in any of the basic non-clinical subjects like anatomy, physiology, biochemistry or pharmacology. He should be eligible for a master's degree after three years of work in any of the above subjects. A Ph.D. degree should also be possible after further research experience for two years.

Training in pharmacology should be oriented to giving the non-medical postgraduates a theoretical background of pharmacology. This can be easily done if the postgraduates are made to attend the lectures of the medical undergraduate course. After one year of basic training, advanced training can be given together with other medical postgraduates, both in theoretical aspects and in various experimental techniques. Attention should be paid to training these postgraduates thoroughly in the experimental procedures. These postgraduates will meet admirably the demands of the pharmaceutical industry and research institutes and will be also useful in various research projects in medical colleges. For some time these postgraduates should also work with the clinical pharmacology sections of the department so as to understand the specific requirements of this aspect of the subject, though it is understandable that the actual clinical trials will always be conducted by physicians oriented to the subject of pharmacology. The training course should specifically lay emphasis on the screening methods for drugs, advanced methods for detailed pharmacological tests, acute and chronic toxicity studies, teratogenetic effects of drugs, etc.

Such a training programme will meet both the objectives, namely, the production of well-trained technicians and non-medical graduates for special higher training in physiology, pharmacology, etc. With a little flexibility of mind and understanding on the part of medical teachers and medical education bodies, such a programme could be made possible without much difficulty.

ing in clinical drug trial carried on in close collaboration with the clinical colleagues is also essential. This will also help in teaching the subjects to the undergraduate students in a more applied manner.

Efficient teaching of undergraduate students and achievement in this particular direction is unfortunately far less exciting than carrying out a research project and publishing a paper. The craze for "publish or perish" has unfortunately deviated many teachers from paying adequate attention to teaching. Most of the postgraduates will eventually become teachers in medical colleges, and hence training them in teaching methods is extremely important. A department which imparts sound training to undergraduates in the subject is, to my mind, doing equally well as any other department carrying out only research work. As a matter of fact, there should be close co-operation between teaching and research programmes and the postgraduate students must be taught to view both these aspects in a correct perspective. All the postgraduates, irrespective of whether they are employed as research assistants or junior lecturers, should be made to participate in undergraduate teaching in an active manner.

To my mind, such a comprehensive programme of training postgraduate students in basic and applied aspects as also in specific and teaching aspects of the subject will turn out postgraduate students who will be good teachers, efficient research workers, and good guides to future postgraduates.

TRAINING AND PLACE OF NON-MEDICAL GRADUATES IN POSTGRADUATE EDUCATION IN PHARMACOLOGY

Postgraduate education in pharmacology in our country has been available to medical graduates only except at one or two universities. Recent expansion of drug research programmes in various research institutes and medical colleges has created an urgent need for the training of research pharmacologists. Establishment of a large number of pharmaceutical factories, with associated research and quality control sections, has further increased the demand for industrial pharmacologists. The number of medical colleges in the country has increased from 15 in 1947 to more than 80 by now, and the number of admissions in medical colleges has also doubled in the last two years. This has created a dearth of teachers in basic medical sciences, including pharmacology. Those of us who are on selection committees of various institutions are painfully aware of the lack of response to advertisements for filling up these posts. A number of teaching and research posts await candidates. The prospects for medical graduates in basic subjects like pharmacology are not as lucrative as in clinical practice and, therefore, the subject fails to attract enough medical graduates.

This utter lack of trained workers in the field of pharmacology and also the different requirements of training of a research and industrial pharmacologist as compared to those of medical pharmacologists, make us seriously think of instituting a training programme for non-medical graduates in pharmacology. Some of my colleagues have often objected to the idea of a non-medical pharmacologist teaching pharmacology to undergraduate students in medical colleges. The objection seems valid to a certain extent, but is not a serious one. Moreover, the need for instituting such a training course is not primarily for increasing teachers for medical colleges, but to fill up the gap in drug research institutions and industry. Even in medical colleges,

EXAMINATION AND ASSESSMENT OF POSTGRADUATES IN PHARMACOLOGY

DR. Y. K. SINHA

THE main purpose of postgraduate education in pharmacology is to produce good teachers and efficient research workers in the speciality. There is a great scarcity of both in this field. A suitable environment has to be created to attract promising young men to this subject which is rapidly growing.

Up to now there is no set curriculum for M.D. or M.Sc. examinations in pharmacology, and it appears that a candidate taking either of these examinations can expect anything. This results in wide variation in the standards of examination from one centre to another. In order to standardise the examinations, it is necessary to formulate a broad outline of syllabus. The medical students could appear in the M.D. examination, whereas others, i.e. science graduates, could do M.Sc. in pharmacology. If the curricula for theoretical and practical studies are drawn, it will be easy for the examiners to judge as to how much to expect from the candidates.

SYLLABUS FOR STUDY

I. Theory

(1) General pharmacology dealing with absorption, fate and excretion of drugs; factors modifying the action of drugs and the mechanism of the action of drugs; biological standardisation of drugs; clinical pharmacology including trial of new drugs; pharmacology for organ systems, including A.N.S., C.V.S., C.N.S., gastrointestinal, respiratory, renal, haemopoetic, endocrine, psychopharmacology, chemotherapy of various infections; antibiotics, sulphonamides, chemotherapy of malignant disease, vitamins, enzymes, local hormones, toxicology of common poisons; pharmacological basis of therapeutics and applied pharmacology; recent advances in pharmacology and therapeutics.

(2) Physiology of important organ systems, particularly of C.N.S. and C.V.S.

(3) Biochemistry including physical chemistry and chemical pharmacology; importance of functional groups and their pharmacological significance; structure activity relationship and the metabolic pathways of drugs and their mechanism of action.

(4) Medical statistics including experimental design, collection and tabulation of data, measure of variation and tests of significance.

(5) Familiarity with original research reviews and papers in journals of the last five years.

II. Practical

Experimental work to elucidate the pharmacological actions and biological standardisation of drugs on various preparations (isolated and vivo); chemical tests of important drugs, i.e. poisons, etc.

EXAMINATION

So far as the examination is concerned, it should be divided into three parts :

Part I — Examination of thesis.
Part II — Written papers.
Part III — Oral and Practical.

Part I—Thesis

The candidate should submit his thesis at the end of the second year of study, if the period of study is three years. It should not be a review work and should comply with the following conditions:

(a) It must form a distinct contribution to the subject and afford proof of originality, shown either by the discovery of new findings or facts or by the exercise of independent critical power.
(b) It must be satisfactory as regards literary presentation and must be suitable for publication.
(c) It must give an account of his research.

Examination of thesis

The thesis should be examined by two or more external examiners. They should be persons who have actually worked or are working in the field related to the subject of thesis. Moreover, the mere recommendation that the thesis is accepted should not be the guiding factor in the assessment of the thesis. In fact, the examiners should be requested to give a chapterwise critical review of the thesis as well as their judgment on the whole. Only if the thesis is found to be of satisfactory standard by all the examiners should the candidate be permitted to take up the other parts of the examination. In case there is a difference of opinion on the standard of the thesis, it may be referred to a third or fourth external examiner as the case may be. If it is approved by the latter, the candidate may be allowed to take up the examination. If in the opinion of all the examiners the thesis is found of a very high order and there is an original contribution, the candidate may be exempted from part II of the examination. These measures are bound to improve the standard of research work and thesis.

Part II—Written papers

There should be at least four papers for the written examination so that the entire syllabus is covered.

Paper I : General pharmacology including biological assay, chemical pharmacology and allied sciences like biochemistry and physiology.
Paper II : Systemic pharmacology, experimental pharmacology and toxicology.
Paper III : Applied and clinical pharmacology.
Paper IV : Recent advances in pharmacology.

The papers should be set by the external examiners only and should consist of three questions in each paper of 3 hours' duration.

Part III—(a) Practical pharmacology

This should consist of 2 or 3 experiments (both vitro and vivo). The primary aim of this portion of examination should be to assess whether the candidate can elucidate the mechanism of the action of drugs or can perform biological assay or do some chemical tests to identify them. The plan and design of his experiment and his basic approach to it should be observed. It should also be tried to know whether he can interpret the results correctly and explain them. There should be one long experiment and two short ones including the chemical test.

(b) Viva. It should be comprehensive and should cover all aspects of the syllabus including medical statistics.

Assessment

The assessment of Parts II and III of the examination should be conducted by a Board of three or more examiners out of whom at least two should be external examiners. There is a controversy about the method of assessment. Some believe that markings in figures should be given for the written, practical and viva voce examinations There is a larger section which holds that the candidates should be graded either by symbolic marking or by giving remarks like good, fair, poor, etc. I personally feel that grading by symbols should be continued but they should be standardised so that grading by the same symbol at one centre is not different from that at another.

The results of the candidate should be on the basis of his overall performance in Parts II and III of the examination, and any shortcoming by the candidate in basic fundamentals should not be ignored. If the overall performance of the candidate in all parts of the examination including the thesis is considered of a very high order by all the examiners, he should be declared to have passed with distinction.

In conclusion it is obvious that if all of us pool our resources and make sincere efforts, there is no reason why the standards of postgraduate examinations in pharmacology cannot be improved.

RESEARCH TRAINING IN PHARMACOLOGY AND THESIS AS REQUIREMENT FOR THE POSTGRADUATE DEGREE

DR. M.Y. ANSARI, M.B., PH.D. (EDIN.), M.R.C.S. (ENG.)

POSTGRADUATE education in pharmacology has been recently introduced in our country. The courses were first started in the older colleges in cities like Lucknow, Bombay, and Madras. With the rapid increase in the number of medical colleges during the last decade, the need for teachers also increased. The demand for teachers was so great and the shortage so acute that the quality of teachers to be appointed could not be insisted upon. Some of our universities even went to the extent of making postgraduate courses less heavy by removing from the syllabus the requirement of writing the thesis. The position with regard to the availability of teachers in the non-clinical subjects is somewhat better now, since the postgraduate courses in these subjects are now being run in several medical colleges.

Only postgraduate degrees are recognised by the Indian Medical Council for teaching posts. The postgraduate degrees which are awarded in the subject of pharmacology are M.D., M.Sc., Ph.D., and D.Sc. The first two are awarded after examining the candidates in theory and practical. In some universities they are required to submit either a thesis or a dissertation. But the other two are awarded on the basis of research only.

For teaching and training postgraduate students, it is essential that the teacher possess a postgraduate degree and research experience. A teacher for undergraduates also requires a postgraduate degree and research experience for maintaining good standards.

Training in research will give an individual a chance to think independently and to make a critical evaluation of the work done by others. It will also train him in various research methods, such as drawing up a scheme, designing experiments, learning the techniques, collecting the data and presenting the results in a proper form. Above all, it will give him the satisfaction of having contributed to the subject he teaches. This would further broaden his outlook and create in him a scientific attitude towards the subject. It can thus be seen that the training in research and submission of a thesis or dissertation are essential and should form part of the postgraduate courses.

How much time should a candidate devote to research and how much to acquiring an allround knowledge of the subject for the M.Sc. or M.D. degree?

Normally, the writing of a thesis should not take more than one and a half years of the two or three years' degree course. During this period the candidate may participate in seminars, symposia and discussions and may also attend the lectures arranged by the department If, on the other hand, the M.Sc. or M.D. degree course is of three years' duration, then in the first two years the student could be engaged in learning the experimental methods and attending lectures, etc., and in the remaining one year he could pay sole attention to his research problem and to the preparation of dissertation. The advantage of

doing the research work in the last year of bis course is that tbe student by that time acquires both theoretical knowledge and training in laboratory work necessary for doing research.

I do not know if some of the universities allow tbe candidates to register for Ph.D. and D Sc degrees directly. In any case, I sbould like to suggest that these should ordinarily be awarded to those who are already in possession of the M.D. or M.Sc. degree. It may then be concluded that the syllabus for the postgraduate degrees, if it is to be geared to the purpose of teaching, must include the writing of a thesis in addition to examinations in theory and practical.

RESEARCH TRAINING IN PHARMACOLOGY

(1) Background

Ordinarily, those candidates are admitted to the medical course who possess either higher secondary or P.U.C. certificates. After admission, they undergo a further course in chemistry, physics and biology for one more year. These courses are not adequate for undertaking research work in the future. Something sbould be done to get over this difficulty. It is suggested that, to provide better qualified and suitable persons for research and teaching, a few seats should be set apart for those students who have done B.Sc. and M.Sc. Another way is to select suitable students and give them an extra year of advance course in pharmacology during their undergraduate studies. This will qualify them to the B.Sc. standard in the subject.

(2) Aptitude

This is very important and the teachers in charge should always be on the lookout for such students during their undergraduate teaching. They may be encouraged and, if possible, introduced to research work by associating them with research projects carried out by the members of the staff of the department.

Two types of candidates can be recruited for such training, namely, medical graduates and science graduates. The latter, though better as regards their general science education, are deficient in their knowledge of human physiology, biochemistry and pharmacology. The deficiencies will have to be made good by allowing them to undergo courses and examinations in these subjects, which should extend over a period of two years. It should be followed by a further period of one year for higher studies in pharmacology and learning research methods. This should qualify them as M.Sc.'s in pharmacology. Such a course has been started in Madras University and some other universities also intend to do so. It may be stated here that such courses are necessary, especially from the point of view of research, as medical graduates in sufficient number are not taking up postgraduate courses in pharmacology. As to the usefulness of non-medical personnel with such qualifications as teachers of pharmacology in medical colleges, it is sometimes pointed out that they would be lacking a medical bias in the subject. However, they may be an asset to the department as research workers.

Advances made in the physical sciences in recent years have provided a number of highly specialised tools which have proved of great help in carrying out researches in biological sciences. The research worker of today, therefore, needs to acquire the skill and special training to use these instruments. Also, he cannot carry out the research by himself and, therefore, requires the assistance and co-operation of other experts. Research has now become a team-work

We need a number of well-equipped laboratories and a team of workers. It is in such laboratories that our young graduates should get their training in research.

But do we have such laboratories? Only a very few of our laboratories could come up to this standard. Most of the pharmacology laboratories are not well equipped and some of them which are, having been equipped adequately through international agencies, cannot be utilised to the fullest extent as suitable personnel are not available. The imported equipment in our laboratories very often lie idle for months together for want of spare parts as well as for minor repairs which cannot be carried out because institutions lack proper workshops. In the interest of research, it is necessary that we should start manufacturing scientific instruments ourselves.

Under the existing conditions, therefore, we have to adjust the research training of our students. The best that could be done is to train them in the principles and methodology of research. They should be given such problems for investigation as could be carried out in the department with limited facilities. Besides this, they should also be trained in various other standard experimental methods used in pharmacological investigations. They should also be taught in the statistical analysis of the data and in the interpretation and presentation thereof in proper form for publication.

To conclude, it can be said that, with the limited facilities that are available at present, a good guide and an able teacher can at least infuse in the students a spirit of true research during the period of their training.

SUMMARY

The writing of a thesis should form part of the postgraduate degrees, as experience in research is necessary for a good teacher of undergraduate students as also for a guide of the postgraduate students. This may also enable him to carry out research independently.

Training in research should mainly consist of training in the research methods at the M.Sc. or M.D. levels.

Non-medical persons should also be trained as pharmacologists with the main purpose of carrying out research. They are better suited for the purpose on account of their better equipment in basic sciences. Medical graduates having B Sc. and M.Sc. degrees should be encouraged to take up research in pharmacology.

To attract medical graduates to pharmacology as teachers and research workers, encouragement and better emoluments are essential.

DURATION OF POSTGRADUATE TRAINING PROGRAMME AND METHODS OF TEACHING

RANITA AIMAN

INTRDDUCTION

MEDICAL education the world over has been in a state of flux in recent times in its attempts to keep up with the rapid advances in medical science in the present century In India, this trend has been further intensified by factors such as political independence which changed the pattern of medical care in the country, the health standards of the nation and the need for their improvement, and, lastly, the population explosion and employment problems Efforts to meet all these have resulted in the rapid increase of medical colleges from 19 to 81 in the last 18 years

Such rapid and revolutionary expansion of medical education in a country where the general academic standard itself is very low has inevitably resulted in a vicious cycle—scarcity of teaching personnel, especially in the non clinical sciences, and the quality of teaching personnel becoming poor with the lowering of the standards of undergraduate training

The direct outcome of this rather unsatisfactory state of undergraduate teaching has been to shift the burden to postgraduate medical education of training good teachers and specialists Postgraduate training, therefore, is an integral part of medical education

NEED FOR SPECIALISTS IN PHARMACOLOGY

In pharmacology the employment potentialities for specialists are, and will, be increasingly high because of the demand for teachers and workers in research institutes, drug control and standardisation laboratories and in clinical pharmacology and the drug industry the last—a very rapidly developing area in India—will be when self sufficiency is attained, one of the largest drug industries in the world

PREREQUISITES FOR TRAINING

That medical science is enriched and made more productive by being broad based, embracing into its fraternity the fundamental sciences of biology, chemistry, physics, etc , cannot now be denied This is especially true of the alliance of pharmacology to chemistry, biology, and biochemistry, so that, even apart from the shortage of teaching personnel from among medical graduates referred to above, it is desirable to have graduates in chemistry or biology as specialists in pharmacology Hence, courses will have to be provided for two types of post graduate students the non medical, full time trainees and the medical "in service ' trainees most of whom will consist of the junior members of the departmental staff

POSTGRADUATE COURSES AND DURATION

The courses proposed are M.Sc. for both categories—medical and non-medical; M.D. for medical; and Ph.D. for both. The duration will be 3½ years and 2½ years for the M.Sc., non-medical and medical respectively; 3½ years for the M.D.; and 3 years for the Ph.D. after a postgraduate degree in the same discipline.

MEDICAL ORIENTATION COURSE

The extra year for the non-medical M.Sc. is to be utilised for a medical orientation course in anatomy, physiology, biochemistry, and microbiology. This course may be common for all non-medical postgraduates—in physiology, anatomy, etc.

BASIC SCIENCE COURSE

For both M.Sc. and M.D. students a preliminary intensive course of six months in basic sciences, common to the other disciplines, is desirable. This is especially required in the present state of undergraduate training where a lowering of standards has been accepted. Such a basic science course, therefore, will facilitate a better comprehension of the methodology of advanced scientific training. The non-medical students would take this course after completing the preliminary medical orientation. This course should include organic chemistry, biochemistry, advanced physiology and medical physics, including medical electronics, statistical methods and instrumentation.

As stated above, the ideal time for studying the course would be prior to the study of the main subject, but in view of the "in service" trainees who cannot be released for an intensive full-time course, it may be necessary, as a compromise procedure, to fit in this course during the period of the main study and complete it within nine to ten months' time.

The above studies form the foundation for the special training in pharmacology and are designed to provide the necessary scientific background and skills.

SPECIAL COURSE AIMS

Before programming the course and the methods of teaching, it would be worth while to define the aims of this course. As I see it, they are:

1. To teach the learning techniques (so sadly deficient in undergraduate education)
   - (*a*) of gaining knowledge from books, journals, etc.;
   - (*b*) of reference work—library study, etc.;
   - (*c*) of collecting personal records—notes, reprints, books, etc.—to form their own library;
   - (*d*) of cataloguing the information thus gained for easy future reference;
   - (*e*) of evaluating information critically;
   - (*f*) of developing the scientific and creative approach to study—not just to reproduce material, or merely understand it, but to be able to apply inductive and deductive methods of reasoning; to analyse and arrive at worthwhile conclusions; to isolate the unknown from the known and finally to contribute new knowledge.

2. To be proficient in the practical techniques of pharmacology.
3. To give some knowledge of such subjects as animal care and breeding, care and maintenance of equipment, appearance of crude drug, etc. Information on such matters is essential for one who will go out for posts of responsibility in this field.
4. To make the candidate able to communicate precisely in written and spoken word.
5. To make him a lifelong student.

DETAILS OF COURSE

Each student should be assigned to a teacher, usually the head of the department, and should form an integral part of the department, participating in as many of its activities as possible—undergraduate teaching, tutorial and practical classes, maintenance of precision equipment, animal care and so on.

LIBRARY STUDY

Library assignments should be given and informal discussion should be held with the teacher on the subject-matter in the first few weeks, till the student has found his feet. Later, guidance may be necessary only on the type of library literature to be covered. The student should be encouraged to do much of the library work outside the working hours of the department.

THE DISSERTATION

The dissertation (called "thesis" by some universities), which should form part of the M.D. course, should be of an investigational type in fulfilment of the aim to develop the scientific and creative approach to work. The term "thesis" may be reserved for a more elaborate and prolonged study, and hence a larger volume of fundamental work should be required for the Ph.D. course while the dissertation would be a less elaborate investigation with a full review of the literature on the subject. It should be acceptable for publication in a journal of repute in two or three instalments. Similar publications may be accepted in lieu of the dissertation.

If one accepts the concept that research is an integral part of teaching, then the thesis is a very important part of the curriculum, as it provides the only opportunity for knowing research methodology. Nowhere does the quality of the teacher play a more vital role than in this facet of training. He should first give careful thought to the problem himself, before he proposes it to the student. After the student has completed the preliminary reference study on it, he should discuss it with him and together they should work out the problem to be studied as well as the experimental design for the work. The work itself should be personally supervised by the teacher in the early stages at least, as also the maintenance of records which should be scrutinised, signed and preserved for submission to the examiners at the time of the practical examination.

As the department will probably be engaged in research on a particular field chosen by the head of the department, the subject for the dissertation could form part of that programme. Needless to say, the aptitudes of the individual student, which may incline to a totally different field, should be taken into consideration.

EXPERIMENTAL PHARMACOLOGY

A set course in experimental pharmacology should be designed to cover all common procedures used for drug study and techniques of bio-assay, commencing first on experiments with isolated tissues and later on the whole animal. If the department has a well-planned undergraduate course in experimental pharmacology, the postgraduates' participation in it as demonstrators will give them valuable experience and knowledge in techniques, especially if these sessions are discussed at a weekly staff conference for possible flaws, improvements, and further staff trial of these. Highly specialised techniques should not form part of the experimental course (e.g. heart-lung studies, psychopharmacology technique, use of the spectrophotometer in the U.V.L. range, etc.). This course should be carried out with the help of the departmental staff and under the overall supervision of the teacher who should insist on standardised procedures.

SEMINARS AND DISCUSSIONS

The teaching staff and students should work out together a regular schedule, in each term, of seminars, symposia (inter-departmental if possible) and discussions. The programme should be planned in order to cover fundamental and special subjects. All members in turn would take special responsibility for one of these, in which the rest should participate.

LECTURES

A few lectures, ideally inter-collegiate, in cities with more than one medical and teaching centre, are also of value, if delivered by an authority in a particular field, not only for content but also as examples of presentation of material.

PH.D. COURSE

The methods of teaching outlined above apply to the M.Sc. and M.D. courses. The Ph.D., which is a research degree, would be carried out in the usual way under a postgraduate guide, generally the head of the department, supervising and directing the research project. The thesis submitted on this work at the end of three years ought to be evaluated by censors of international repute.

UNDERNOURISHMENT OF TRAINING PROGRAMMES

It is probably correct to assert that, while undergraduate teaching in this country tends towards spoonfeeding (often justified and necessary because of the weak background of training of the students in schools), postgraduate training, on the other hand, tends towards undernourishment. While it is absolutely important that the students should do independent study and work, this does not exonerate the department or its head of the need to organise a well-designed and executed (with the same meticulous regularity and care as the undergraduate schedules) postgraduate training programme to fulfil the aims of postgraduate education. This is not in the least accomplished by merely organising weekly journal clubs and giving a few suggestions and instructions for the dissertation, necessitating sometimes a change of subject in the middle of the course for this work.

CONCLUSION

Finally, I should like to stress the "execution" of the programme, as it is not really the paper content of the curriculum that counts but rather the atmosphere of earnest and honest endeavour to create a co-operative effort in the search for scientific knowledge and truths. The personality, pursuits and principles, rather than the precepts, of the teacher will shape the pharmacology of India today and tomorrow.

TEACHING OF PHARMACOLOGY AND THERAPEUTICS AS A CO-ORDINATED PROGRAMME TO POSTGRADUATES

DR. N. K. CHOWDHURY

THE theory and practice of medicine have their place within the wider boundaries of biology, and pharmacology and therapeutics are to be found at the growing edge of clinical science. The central problem of medicine may be phrased in the simple question: How best to treat the patient? But after we grant that patients' welfare is the centre of all medical teaching and practice, at postgraduate or at undergraduate level, we must then ask why we treat them the way we do. In general, physicians can offer one or both of the two answers:

1. Experience shows that the treatment works.
2. Reason confirms that it ought to work.

These two categories, experience and reason, empiricism and rationalism, represent the two polar aspects of medicine, the practice and the theory, the therapeutics and the pharmacology. I may be permitted to say that empiricism indicates how to do something, while rationalism tells us why we do it.

On account of the extremely fertile mating of the synthetic chemist with the pharmaceutical manufacturers, drugs appear on the market almost too quickly and it is difficult to learn the names and distinguish between the same drugs with different proprietary names. It is also a difficult job to learn enough about them and evaluate their relative therapeutic merits. Yet the choice of a drug will determine whether the patient will receive the most judicious combination of therapy.

Teaching of pharmacology and therapeutics should be co-ordinated at the postgraduate level in such a manner as to make it practicable, and not cumbersome and unusually dry. However, in attempting to do so, the objective of teaching at the postgraduate level should not be sacrificed.

My personal feeling is that for such a co-ordinated programme of postgraduate teaching we require hospitals and medical schools, constructed in close proximity with the avowed purpose of creating a clinical facility dedicated to the integration of patients' care, medical teaching and research. This objective could best be implemented by having in medical schools and universities an academic staff on which chiefs of the hospital service hold professorial appointments. Hospitals should be of a size adequate to provide an adaptable and flexible ground for the application of new concepts in pharmacological teaching and patient-care.

There should be expansion both in research and teaching activities. The point central to this concept is that it should be possible to make the discoveries of basic pharmacological science applicable to, and transplantable into, the effective teaching of postgraduates and the treatment of patients in the shortest possible time. A co-ordinated approach of this type is designed to

increase the probabilities of utilising the important basic medical, scientific information of pharmacology and its clinical application.

In our country, postgraduate teaching is confined either to a discussion of the pharmacology of drugs, without giving enough information to trainees regarding the selection and effective use, or else limited to practical therapeutics. Pharmacological concepts are ignored, without which efficient use of many drugs becomes difficult and even impossible. Except those who are idiosyncrats, all others will agree with me that nowadays it is too much to expect the overburdened postgraduate to consult and integrate two divergent types of teaching programmes. A co-ordinated teaching programme of pharmacology and therapeutics will give them a reasonably brief solution to the problem of combining practical and clinical utility with an essential account of pharmacology.

Drugs should be taught in order of their choice, but drugs of the second order of choice should not be neglected. When emphasis is on the first order of drugs, we shall choose the best drug for the clinical problem at the outset of the treatment, and this will have the following advantages: (a) For a serious patient, time may be precious; if the first choice is the best drug for the situation, then time and drugs are not wasted. (b) Drugs short of the best may provide incomplete relief or no relief at all or untoward effects or disaster. (c) The patient may be reluctant to continue with the trial and error.

Essential pharmacological information obtained from the laboratory, animal experimentation and from data developed through studies in man should be conveyed. Not only these data but also their proper interpretation is essential. As far as possible, the indications, contra-indications, potency, and the dangers of each recommended drug or method should be discussed to give an idea of therapeutic potential and its safe use. Further, an attempt should be made to indicate why and when certain drugs and methods, used already, should not be used again. An important point to be emphasised is the nature and extent of the benefit expected from a particular therapy.

A practical consideration which needs considerable emphasis is the pattern of drug action, potency, absorption, distribution and excretion along with administration by an acceptable route. The potency should always be in relation to the therapeutic ratio.

Whenever a drug is given, a risk is taken. Often it is so small that a second thought is hardly necessary, but sometimes it is substantial and needs careful scrutiny. The welfare of patients depends upon the doctor, his knowledge of drug and disease, and no less on his experience of both. For instance, in enteric fever the risk of inducing aplastic anaemia with chloramphenicol is far less than the risk of death from untreated disease. In less dangerous infections, however, the decision is less easy. For example, in chronic bronchitis, chloramphenicol is likely to lead to sensitization and, therefore, subsequent administration produces fatal results. This information is worth transmission in order to avoid ignorance and irresponsibility resulting in iatrogenic diseases.

Many drugs have more than one action and more than one sphere of clinical application, e.g. 1. Diamox—as diuretic, as antiepileptic and in glaucoma. 2. Chlorthiazide, as diuretic, as hypotensive agent and in diabetes insipidus. 3. Reserpine as hypotensive and tranquillizer: Such drugs will have relative utility and clinical applicability.

Recent advances in the physiopathology of various diseases have led to the development of biochemical signs. The knowledge of biochemical defects of the cell has led to the development of drugs, thus correcting these defects.

1. Alpha methyl dopa acts as a hypotensive agent by either blocking the synthesis of nor-adrenaline or by formation of pseudo-hormone alpha methyl nor-adrenaline.

2. Phenylketonuria and galactosaemia are two diseases due to the congenital enzymatic defects which can be treated by giving alanine and lactose diet respectively and by giving largactil in phenylketonuria.

3. Folic acid deficiency results in megaloblastic anaemias, because it is essential for the formation of purines and pyrimidines which, in turn, are essential for DNA and RNA synthesis. Folic acid benefits in such cases.

4. In malignant conditions there is an overgrowth which requires excessive amounts of RNA and DNA. 6 M.P. is a drug which is converted into 6 M.P. riboside and which is incorporated into nucleic acid and abnormal nucleic acids are formed and growth is checked.

5. Anti-folic agents of irreversible group aminopterin, amethopterin not only block the enzyme dihydrofolic reductase but also interfere with the utilisation of folic acid.

6. Carbonic anhydrase is an enzyme which plays an important role in the reabsorption of sodium in renal tubules. Diamox and chlorthiazide by inhibiting this enzyme produce diuresis and reduce oedema.

7. M.A.O. Inhibitors raise the concentration of 5-HT and nor-adrenaline in brain; this is responsible for the C.N.S. stimulation.

8. M.E.R.-29 (Triparanol) acts by blocking the conversion of desmosterol into cholesterol.

9. Spirinolactone inhibits the enzyme system which is responsible for the synthesis of aldosterone and hence it reduces oedema.

10. Pyramidine analogue, 6-Azauracil, is incorporated into RNA which is abnormal. Such an abnormal nucleic acid does not permit chromosomal division.

Our understanding of the biochemical mechanisms of drug action has progressed to a point where a pharmacologist can often design a chemical structure and predict its pharmacological action, on the basis of basic concepts of structural activity relationship. This point needs emphasis in a co-ordinated teaching programme wherever a new drug has been developed from an old drug of known chemical structure or when a metabolic analogue of an essential metabolite has been developed. The first example of the former is oral hypoglycaemic agents developed from carbutamide which is sulphonyl-urea with free NH_2 group in para position of the benzene nucleus. This drug shows all the pharmacological effects of a NH_2 group in para position in the form of antibacterial and antithyroid, bone marrow depression, binding to plasma proteins and acetylation before excretion. All these actions are reduced considerably in newly tailored products—tolbutamide, chlorpropamide and acetohexamide—and these drugs are more effective hypoglycaemic agents. A second example could be thiazide diuretics, which illustrate this point, and the third example could be various anticancer polyfunctional alkylating agents which have different carrier groups attached to them and are derivatives of nitrogen mustard, e.g. mannitol mustard, cyclophosphamide, chlorambucil.

Recent physiological and pharmacological researches have led to the recognition of highly

active substances in body occurring naturally. These are called chemical transmitters, neuro-hormones or local hormones depending upon the site of their action and the physiological role they play. Not only do these neurohormones play a physiological role but they are also responsible for the pathological manifestations of various diseases, e.g. in carcinoid tumor there is excessive production of serotonin and in pheochromocytoma there is excessive production of nor-adrenaline and adrenaline. This neurohormonal concept has assumed considerable importance in modern medical treatment because today we know of drugs which can modify the function of the body by liberating, blocking, reducing or increasing concentration of these neuro-hormones in the body, for instance:

1. Guanethidine (Ismalin) releases catechol amines, particularly non-adrenaline from tissue stores, from sites closely associated with adrenergic mechanism, and reduces sympathetic tone and B.P.;

2. Reserpine acts by liberating tissue stores of 5-HT, non-adrenaline, adrenaline and dopamine;

3. M.A O. inhibitors block the enzyme monoamine oxidase responsible for the destruction of 5-HT and non-adrenaline and their concentration in brain and body rises, resulting in excitation and relief from depression.

There has taken place an explosion of interest in the pharmacological aspects of psychiatry. Biochemical concepts are proposed for mental disorders, e g. indole metabolism disorder. Basic psychopharmacological concepts should be taught to the students in co-ordinated teaching.

The effect of a drug is dependent upon inter-action between the drug and its recipient. When the factor of immaturity is realised, as in children who are not miniature adults when reacting to drugs or disease, a number of special factors have to be considered for infants and children in the proper selection of drugs and dosage. Among these are: 1. effect of immaturity on therapeutic response; 2. possibility of effect on growth; 3. difficulties in administration.

In the end, I must emphasise that as far as possible such a teaching should be based on original manuscripts and publications and on the experience of the teacher.. References to original publications should be recommended, the aim being to provide a contact with the original mind in the field.

I hope I have succeeded, at least to a certain extent, in bringing out the contributions that this science has made and is making to medicine, and everyone of us has sound reasons to be quite proud of its achievements. If such a co-ordinated teaching programme is implemented, it will be an experiment which will pave the way for rational therapy.

REPORT OF THE SUB-COMMITTEE ON PHARMACOLOGY

BY

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NOMENCLATURE

THE postgraduate degrees in pharmacology should be M.D. for medical graduates, M.Sc. for non-medical graduates, and Ph.D. or D.Sc. for both. In view of the advances made in the study of pharmacology, there is need for specialisation in certain branches of the subject. To meet this need, diploma courses should be instituted in experimental pharmacology with special reference to bioassay, cardiovascular pharmacology, chemotherapy, toxicology, clinical pharmacology, neuro-pharmacology and biochemical pharmacology. Candidates eligible for these diploma courses should be those with M.D. in pharmacology and therapeutics.

SYLLABUS

The courses should be for three years. During the first year, the candidates should be given lectures in each of the basic sciences, viz. physiology, biochemistry, biophysics, medical statistics and microbiology as applied to pharmacology. They should have a thorough training in all the branches of pharmacology studied by undergraduates, and should also become well acquainted with all the routine procedures of experimental and biochemical pharmacology and elementary pharmaceutical chemistry. Non-medical graduates should attend the lectures in pharmacology along with the undergraduates.

In the second and third years, candidates should be taught the history of pharmacology, general and cellular pharmacology, recent advances in pharmacology, neuro- and psycho-pharmacology, chemical pharmacology, pharmacotherapeutics, clinical pharmacology, toxicology and the various methods in experimental pharmacology, including bioassay methods.

METHODS OF TRAINING

It is suggested that an average of three research fellowships of Rs. 400 per month be provided in each department.

Candidates should be posted in the department for the duration of the course in which they have registered. They should be given training in all the sections of the department as well as in clinical and allied departments. They should learn to use and review library books and participate in undergraduate training.

such as M.D., Ph.D. or D.Sc. or M.Sc (Med.) with the basic M.B.B.S. degree; one additional professor of pharmacology with the same qualifications as the head of the department; one additional professor in chemical pharmacology with Ph.D. or D.Sc. degree; one reader in pharmacology with M.D. or M.Sc., Ph.D. or D.Sc. degree; one reader in chemical pharmacology with M.Sc. or Ph.D. or D.Sc. degree; three lecturers in pharmacology (with M.Sc. or M.D. degree) of whom one is a postgraduate in chemotherapy; one lecturer in chemical pharmacology with M.Pharm. or M.Sc. degree; two non-medical demonstrators or junior lecturers with B.Pharm. or M.Sc. degree; and five medical demonstrators or junior lecturers with M B.B S. of whom two should be permanent and the other three on three-year probation.

To attract suitable teachers to the department of pharmacology, the following changes should be made: (a) the pay scale recommended by the Mudaliar Committee should be implemented for professors, readers and lecturers; (b) demonstrators should be given the pay scale of Rs. 375-25-425 plus Rs. 150 non-practising allowance; (c) the age of retirement should be raised to 62 years (extendable to 66 years) as in the case of university teachers; and (d) demonstrators without a postgraduate degree but with adequate teaching experience may be appointed as temporary lecturers. The number of non-teaching staff should be adequate for 150 undergraduate admissions.

CHEMICAL PHARMACOLOGY SECTION

There should be an efficient chemistry unit, with facilities for synthetic pharmaceutical, physiochemical, and biochemical work.

ANIMAL ROOM

Every institution should have a central animal house for procurement, stocking and breeding of all experimental animals from which the department of pharmacology should get its supply of animals. In addition, each department should have one or two animal rooms.

Each institution should have a central workshop with adequate staff and equipment for the repair and maintenance of departmental equipment with facilities for constructing minor apparatus and appliances. The workshop should provide facilities in electronics, glass-blowing, mechanics and carpentry.

DRUG SCREENING UNIT

On account of rapid expansion of the drug industry, there is an increased need for clinical evaluation of drugs. Therefore, there should be a drug screening unit, installed in every department of pharmacology with beds, set apart for research.

EQUIPMENT

Depending upon the number of postgraduate students and the type of work in which the department specialises, there should be certain other equipment in addition to that recommended for undergraduate medical education by the Medical Council of India.

ORGANISATIONAL PATTERN OF A POSTGRADUATE TEACHING PROGRAMME IN PATHOLOGY—PRESENT AND FUTURE

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A large number of medical faculties in the country are imparting postgraduate medical education in pathology. The organisational pattern of teaching and assessment varies from university to university with the result that there are marked and obvious differences in the standard of postgraduates produced. It has to be admitted that the situation is unfortunate, and most of the educationalists feel that a time has come when every effort should be made to meet the minimum requirements for postgraduate education of pathology in the institutions already undertaking or wanting to undertake such an educational programme.

The sectional committee would discuss the various aspects of postgraduate education along the following lines:

A: The purpose for which the postgraduate in pathology has to be trained.
B: The minimum requirements for a department of pathology for postgraduate teaching, including physical facilities, staff, their qualifications, etc.
C: The candidates for postgraduate education and methods of selection, etc.
D: The curriculum, content, methods of teaching and assessment, and quantum of research.

I do not wish to go into the details of these facets and am eagerly looking forward to listen to the teachers who have been invited to present specific papers. However, I would take this opportunity for indulging in loud thinking regarding some of these problems.

What are our objectives in postgraduate education in pathology? Broadly speaking, the postgraduate training programme has to be so organised as to:

(a) produce postgraduates to man the teaching departments and carry on research,
(b) produce specialists for laboratory services as a part of patient-care programme and, finally,
(c) impart postgraduate education in pathology to the postgraduates of the clinical subjects.

It is obvious that the training of these three types of postgraduates will vary both in intensity and in the organisational pattern of the teaching programme. It would be ideal to produce a postgraduate in pathology who is competent to be a teacher, research worker and investigator. This is too much to expect, and even one or a combination of any two of them should be satisfactory. The present training programme for the three types of postgraduate qualifications, M.D., Ph.D., and the diploma, broadly helps channelise the candidate to

(c) Specialised pathologists of the grade of Associate Professor in charge of each of these units.

(d) Postgraduate research laboratories, air-conditioned instrument room, conference room.

(e) Well-equipped departmental library.

(f) Complete co-ordination and co-operation with other basic and clinical departments.

I attach great importance to the correct selection of postgraduates for training. In our institution, the students are selected by the College Council of Postgraduate Education and Research and this has proved a success. Postgraduate education should be given only to those who have had an outstanding undergraduate career and have developed a certain amount of devotion and loyalty to the subject. The incorporation of undergraduates in the research programmes of the department has helped us to channelise some outstanding candidates for the ultimate career of pathology. I feel it is very important that an undergraduate be given a chance during his training period to breathe in the atmosphere of the department of pathology in order to make up his mind. Two to three months in the period of internship should also be spent in the department of pathology.

The question of research as part of a postgraduate teaching programme is extremely important and one bears conflicting views regarding the desirability of research, its quantity and the time to be alloted to it. After postgraduation, the doctor is required to perform one or two or all the three of the functions expected of him, viz. medical education, medical research and patient-care. To be competently equipped for this, he has to develop a dynamic outlook towards medicine. It is only then that he can cope with the ever-expanding sphere of knowledge and approach the ever-arising newer problems in the manner of a scientist and research scholar imbued with the spirit of critical evaluation. Postgraduate education does not only mean a sound knowledge of the subject-matter; it also means the development of independence of thought, habit of logical thinking, sense of responsibility and initiative.

This can only be achieved by a radical change in our teaching concepts whereby training in research methodology and actual participation in departmental research programme should be introduced. With strict control over the admission to postgraduate degrees, such a training should be compulsory for the award of the degree. It should not be confined to a few showing a propensity and ability for research.

I am of the firm opinion that training in research methodology and actual participation in a research project should be obligatory for the award of a degree, specially, for the degree of M.D. The examination should consist of a thesis, theory and practical papers. Ph.D. and D.Sc. degrees being purely research degrees will naturally require a high standard of research achievement.

When during the student's training period should this thesis be prepared? I think a student should be given the option to submit his thesis before or after the theory and practical examinations. The degree will not be awarded till he has passed these examinations and the thesis has been accepted by the examiners.

One of the important deterrents to the success of such a programme is the lack of facilities for research. Mere allotment of a subject for experimentation without giving the student an opportunity to familiarise himself with the basic knowledge is likely to introduce wrongly evaluated

data leading to completely unwarranted conclusions. The training in statistics and its use should be an integral part of a research student's requirement.

The quality and quantity of research for a thesis will ultimately depend upon the research orientation of the staff, the facilities in the institution and the research programmes of the department. A laboratory of experimental pathology should be organised and a post of experimental pathologist should be created. It may be necessary to send these students to other laboratories in the country for short or long periods where better facilities for successful development of their problems exist.

Finally, I would say a few words about the evaluation of the thesis. The thesis should be unanimously approved by the examiners and in case of disagreement an additional opinion should be sought. I prefer gradation of the thesis as A, B and C, the last signifying rejection. A short *viva-voce* should be held for the defence of the thesis and credit may be given jointly on the basis of the thesis and the performance in the oral examination. The credit may take the form of exemption from a part of the examination.

I hope I have been able to put forward my views on some of the important topics of postgraduate education. I would reiterate that postgraduate education should not be taken lightly by the faculties. There should be some machinery, which is at present the Medical Council of India, whose task it should be to recommend regarding the staff, physical facilities, equipments, etc. required for an institution intending to take up postgraduate teaching. The posts of postgraduate teachers should be created in every faculty and financial assistance should be available for the creation of necessary facilities if the postgraduate education in this country is to keep pace with similar educational programmes elsewhere in the world.

AIMS AND CONTENT OF THE POSTGRADUATE PATHOLOGY CURRICULUM

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ONE often wonders if it is wise or even possible to outline the content and curriculum for postgraduates in any speciality in medicine, much more so for pathology. Medical knowledge has overgrown in recent years and innumerable techniques have been perfected and it is difficult to pack them up in a two or three years' course. The rapid growth of medical knowledge in recent years has been exciting and its effects upon medical education, research, and medical practice are sometimes frightening. The training of a postgraduate does not aim at storing information, but rather at how to obtain information and from where as the occasion demands. All that we were told was that the postgraduate examination is of a high standard and that a student must know everything under the title "Pathology in its Broadest Sense." This naturally frightened many and they were neither certain of their achievements nor of qualifying the examination. Things have considerably changed since then and postgraduate teachers are now busy with teaching and training programmes attempting to acquaint the postgraduate with the speciality in which he is interested. Some universities in the country prescribe a syllabus, others leave it undefined and some conduct a regular course of practical and theoretical aspects of the subjects. Since there has been an increasing demand for improvement in the quality and quantity of medical education, research and patient-care, we must clearly define our aim. Financial support for teaching and research has been gradually expanding. Financial, social and general educational status of the public has also developed sufficiently to demand marked improvement in medical care.

Pathology is the study of diseases, their causes, how they start, how they progress, how they terminate, and how the body reacts and adopts itself to injury. Thus, since the days of Louis Pasteur, the horizon of pathology has gone beyond "morbid anatomy" taught and demonstrated by J. P. Morgagni and Carl Rokitansky. This raises the important controversy whether the postgraduate training in pathology and bacteriology, and sometimes in chemical pathology and clinical haematology, should not be grouped together as is done in the universities in the North or the training be of distinct patterns for those specialising in pathology or bacteriology as in the universities in the South. The latter is preferred because the postgraduate student in pathology usually spends more of his time on tissue diagnosis at the cost of bacteriology and chemical pathology. Moreover, in this setup, bacteriology and chemical pathology laboratories do not function well and their growth is often stunted. These departments need be given independent existence in view of the rapid advances in these subjects. One often wonders whether,

as in the United States, the postgraduate training may not be given in (1) clinical pathology, (2) morbid anatomy and (3) bacteriology, and whether they may not be recognised as separate specialities.

An important fact that needs to be considered in this context is whether the postgraduate training in pathology or in the other specialities of medicine should be confined to research pursuits leading to the award of Doctor of Medicine or Ph.D. or whether it should be conducted on the pattern in vogue in this country and in the College of Pathologists in England and in the Speciality Boards in the United States of America. If the aim of postgraduate training in pathology and bacteriology is to prepare students for the Doctor of Medicine, then the curriculum outlined below may be considered.

The training in pathology should be designed so as to make the candidate competent in the diagnosis of tissue and there should be no compromise on this. At the same time, as in many universities, the syllabus should not be biased to one side by totally excluding certain topics. It is desirable to adopt a common pattern of syllabus throughout the country. The postgraduate student in pathology is to be trained in order that he may render competent service to the hospital (Service Pathologist), undertake teaching in pathology (Academic Pathology), and be an investigator or participate in the research schemes of the institution. He should, therefore, acquire knowledge of basic skills, of methodology and of techniques normally used in a clinical laboratory and should be able to guide in processing clinical material that flows into a laboratory. He must be able to offer opinion, interpret the results obtained and discuss with his clinical colleague cogently and with confidence problems referred to him at a consultant's level. He should learn and be aware of methods and tools of research and familiarise himself with their use and maintenance, and should know how to take care of laboratory animals. To learn to sort out, to evaluate the results of animal experiments, to appreciate the role of controls, to be able to communicate ideas and to introduce the postgraduate into methods of self-education, all these it should be his constant aim to acquire, surely and gradually. He should grasp the basic concepts of mechanisms of disease and attain a degree of competency in recognising the lesions, and should develop the capacity to interpret the findings by observation and reasoning. Also, he should create interest in the postgraduate to read extensively and critically, to think in precise terms and to arrive at conclusions by himself. He is to learn to employ skilfully the laboratory data to arrive at a diagnosis. Above all, he must educate him to develop the spirit of investigation which will encourage habits of thinking.

What should be the duration of such a training? Taking into consideration the general trend in the country, three years is the minimum period. Should the candidate produce a record of original work carried out on his own or under the guidance of his master, or present a record of autopsies witnessed or carried out, or a critical analysis of the biopsies in the form of a review? It is generally agreed that the candidate is expected to present a thesis based on the experimental work carried out by him and that, on approval of the thesis by a duly appointed board of examiners, he should be allowed to take the written, practical, and *viva voce* examinations. This gives him training in choosing a problem for investigation, in designing the experiment, in sorting out or rejecting data and in arriving at independent conclusions. In this endeavour, the teacher acts as a guide. The best way to train the postgraduate is through the method

of residency programme in which the student's capacity for independent responsibility increases and the need for close supervision diminishes, access to ready consultation being available.

CONTENT AND CURRICULUM

The rotating type of residency training should aim at making the postgraduate, while working in the necropsy cytology and biopsy services, appreciate and understand the cell, its structure, its enzymes, its chemistry, etc. in health and in the process of disease. He should be able during this period of training to visualise the lesions commonly described under general and systemic pathology covered in the book on pathology. This would, in course of time, enable him not only to appreciate disease processes but enable him to be competent in tissue diagnosis. As such, he must be able to witness and carry out at least 60 autopsies during the period of training. The biopsy services of a training centre should have a minimum of 4,000 specimens to report annually and should include both surgical and gynaecological specimens. It is desirable that the postgraduate, when posted in these sections, is held responsible for the management of the section, of course under the supervision of a senior teacher, so that he evinces pride in the diagnosis and in offering opinions. In course of time, through autopsy conferences and biopsy seminars, he would begin to learn through discussion which always helps in thinking and critical assessment. He begins to realise that behind a slide is a disease process, a clinical picture which enables him to forecast prognosis, to reflect over functional and chemical changes, causal factors and changes in body fluids, if any. All these offer materials for discussion for differential diagnosis. Thus, a student should spend at least over a year in these sections.

CLINICAL BACTERIOLOGY AND ALLIED SUBJECTS

In recent years, the growth of bacteriology, serology and immunology has been so phenomenal that it is impossible for a postgraduate student to know everything on the subject. Since he must be in a position to manage a clinical laboratory and also to undertake to teach and apply research techniques, he should go through the practical aspects of the subject. He should observe and carry out methods of sterilisation, media preparations, egg and tissue culture techniques, and go through routine diagnostic bacteriology, virology, parasitology and mycology. He should be able to handle materials that flow into the laboratory and in this way he would learn the principles of serology and immunology as applied to patients. Organised lecture demonstrations on these topics are very useful for appreciating the value of clinical medicine. Three months of practical training is necessary.

HAEMATOLOGY

Haematology has acquired at many places an independent speciality status, but the student of pathology must go through practical training in haematology so as to be able to identify normal and immature cells in blood, their enumeration in health and in disease. He should acquaint himself with the morphology of blood cells in anaemias, leukamias, and thrombocyto-

paenic purpuras, and a variety of other states. He should also know the methods of recognition of haemoglobinopathies. A practical knowledge of blood groups and immunohaematology, the nature of haemoagglutinins, leucocytic and platelet anti-bodies is essential. He should also obtain information on auto-immune mechanisms in disease as well as the use of radio-isotopes in haematology and other conditions.

CHEMICAL PATHOLOGY

The changes in body fluids are to be recognised in disease through measurement. To understand the functional aspect of disease, an insight into biochemical reactions is required. Hence, the student should learn the metabolism of carbohydrates, proteins, and lipids as also of serum enzymes in normal and abnormal states. The postgraduate student of pathology needs to acquire only a working knowledge of the methods employed in a biochemical laboratory for the interpretation of the results so as to understand the disease processes. He may have to work for two months in the laboratory and take advantage of lecture demonstrations during that period. He may have to learn the use of such subjects as calorimetry, electrophoresis, paper chromatography, simple volumetric and gravimetric analysis of tissue fluids together with the principles of the working of spectrophotometry, histochemistry, exfoliative cytology, and cytochemistry.

COURSE ON INSTRUMENTATION

Practical training in laboratories is absolutely necessary. The postgraduate should know how to recognise various enzyme reactions in the tissues and cells. Since Papanicolaou staining technique is an acknowledged screening method of malignancy, the student must learn to collect materials from various organs, stain them and be trained to spot malignant cells. Since a pathologist has to use himself and to guide the use of many instruments, it is better that he is given a practical course on instrumentation which requires apparatus used in biochemical and bacteriology laboratories and also the use of a variety of microscopes, such as D.G.I., Phase Contrast, Interference, Electron Microscope, and knowledge of immunofluorescence techniques.

GENETICS

Though a young science, genetics has acquired a prominent place in clinical medicine. Genetic bases of metabolic diseases, congenital malformations and degenerative conditions are being studied today with avid interest. The principles governing simple gene transmission and action must, therefore, be understood as also the phenomena of bacterial variation and mutation and their application to antibiotic therapy and bacteriophages. Some knowledge of physical bases of heredity and an understanding of the mechanism of chromosomes in cell division and the genetic implication of miosis should also be acquired. An understanding of mutation and its evolutionary significance with special reference to the experimental production of mutations by ionising radiations is necessary. The graduate must be made aware of the possible mutational hazards of the roentgen rays and atomic energy. Instruction in practical problems of genetic counselling and medico-legal application of blood-grouping needs to be emphasised. The graduate must learn to recognise sex chromatin in cells, leucocytes, and be familar with

chromosomes and their morphology in health and in disease. To achieve this, a practical course in genetics may be necessary.

CLINICAL PATHOLOGY

Most of this has been covered under the topics mentioned above. For the application of methods and the use of precision instruments for the solution of the problems of medical diagnosis, which would help in the evaluation of the consequences of disease, the student must work in the laboratory. He can understand and realise the limitations of the results of tests and the correlation of these results with given clinical situations. A careful selection of the tests through familiarity with the procedures he can go through in the laboratory is thereby cultivated. He will appreciate the range of normal and abnormal values and application of the principles of probabilities, and will appreciate basic pathologic lesions revealed through clinical pathology, specially of liver, kidney, stomach, etc. Hence, wherever hospital laboratories exist, the graduate must try to gain practical experience and make use of these.

ANIMAL EXPERIMENTS

These experiments are apart from those the student performs for his thesis. If he has not done experiments with animals as an undergraduate, a course must be designed for him, for this would help him to select a project, design the experiment and evaluate the results. These experiments will impress upon the graduate the dynamic concepts of disease and provide some experience in experimental methods. The subject-matter of experiments may be inflammation, nephrotoxic nephritis, atherosclerosis, hepatic necrosis and cirrhosis, carcinogenesis, etc. The purpose of these experiments is to develop a maturer appreciation of certain areas of knowledge rather than to transmit factual material.

I have by no means exhausted the contents of the course but have only given an indication of a bare outline. To teach this course, a variety of teaching media need be employed which may take such forms as lecture demonstrations, conferences, seminars, symposia, group discussions, journal clubs, clinico-pathological conferences and planned laboratory exercises. In the conferences, surgery, obstetrics and gynaecology, and internal medicine should be included so that the student realises and appreciates his role in the diagnostic team. In recent years, the science of pathology has grown very rapidly. Gone are the days when pathology could be taught by a series of lectures.

STRUCTURE AND FUNCTION OF THE POSTGRADUATE DEPARTMENT OF PATHOLOGY

DR. B. K. AIKAT

THE concept of pathology as a scientific discipline has undergone the natural process of evolution and pathology has emerged as a dynamic study of disease processes both in their morphological and functional expressions. It has thus become an exacting discipline. Many specialities, such as biochemical and biophysical techniques, are now included under pathology. Any comprehensive programme of postgraduate training and teaching must recognise that the study of pathology involves many subtle and complex investigational procedures. It is, therefore, necessary to indicate clearly the specialities which have to he developed and included in postgraduate departments undertaking teaching, research and training in pathology.

Broadly speaking, pathology can be divided into the following specialities:

(I) Morhid Anatomy

This should include phase-contrast, interference and electron microscopy.

(II) Cytology and Cytochemistry

It has become essential to categorise cell damage at biochemical levels and correlate such alterations with specific structural changes as are revealed by electron microscopy and micro-spectro-photometry.

(III) Cytology and Cytogenetics and Immunogenetics

The study of cell as a unit and its molecular biology is becoming increasingly important for such problems as pathogenesis of cancer, "controlled alterations of genetic material and even space biology." Advances in molecular biochemistry have offered adequate tools for the study of gene structure and function. The application of genetics as an aid in diagnosis and prognosis has become one of the most important avenues of investigation and research. "The science of genetics seeks knowledge of gene from many aspects, including:

(1) the means by which the information is coded in the chromosomal material,
(2) the means by which genes affect development and function, both normal and abnormal,
(3) factors altering gene structure, i.e. gene mutations,
(4) the causes and pathological effects of chromosomal aberrations,
(5) the variability in expression of genes in different genetic backgrounds and in different non-genetic environment,
(6) the distribution of genetic differences within families, and
(7) the distribution of genetic within and between populations."

(IV) Immuno-Pathology

This new concept of pathogenetic mechanism offers great opportunities for the study of diseases. Immunological techniques which can be utilised to characterise and categorise disease processes need to be developed. These techniques are exacting in their performance as well as in their interpretations.

(V) Experimental Pathology including Cancer Research

It is not necessary to emphasise the importance of experimental approach in the understanding of diseases and its usefulness in cancer research and genetic studies. The provision of colonies of standard strains of animals, a well-organised animal house and an active experimental pathology section is invaluable for teaching, training and research in the various fields in pathology.

(VI) Tissue Culture

This has developed into one of the useful tools in the study of teratology and neoplasia and fundamental cell biology.

(VII) Haematology

Haematology has almost emerged as a separate discipline and includes morphological, cytological and cytogenetic approaches which are common to morbid anatomy.

Immuno-Haematology is now recognised as a sub-speciality. Blood coagulation and its disorders have acquired sufficient importance and complexity to demand whole-time attention. The technological methods are exacting and the knowledge is far from complete. Blood dyscrasias, particularly leukaemias, offers a great challenge to cytologists, geneticians, biochemists and virologists.

Biochemical and biological estimations of the essential requirements for haematopoeisis and their disorders have become routine procedures. When one includes the haemoglobinopathies and other "molecular diseases" affecting the haemopoeitic system, it will be evident that all these can be achieved by a multi-disciplinary approach common to other branches of pathology.

(VIII) Chemical Pathology

This important branch of pathology needs to be developed and strengthened not only for understanding the patho-physiology of diseases but also for initiating and developing essential biochemical techniques for other branches in pathology. The achievements of a department of pathology will depend on the growth, development and efficiency of its basic technological divisions of biochemistry and biophysics.

This brief review brings into focus the far-reaching developments in the various specialities embracing pathology. Each of these specialities, embracing specialities, and sub-specialities has made rapid progress and has emerged as a separate discipline.

Pathology is an applied science which bridges the basic medical sciences with clinical medicine. It deserves to be organised with foresight and objective so that it can fulfil

effectively its unique role in the medical curriculum, particularly in the sphere of postgraduate medical education and research.

If one concedes the extent and magnitude of the growth of this discipline, it will be unrealistic to minimise the necessity of developiog the essential specialities included under pathology.

Personnel. Obviously, this will need trained staff who, apart from their training in the broader discipline, have opportunities to acquire sufficient efficiency in and capability of developing techniques which can be effectively used in one or the other of the specialities. There should be one, or preferably more, individual specially trained in each of the specialities enumerated above.

Modern medicine requires biochemical and biophysical methods for diagnostic and research procedures. The association and collaboration of both these two basic disciplines is not only natural but essential. The department of patho-physiology must have sections of biophysics and biochemistry as its integral part.

Equipment. Biophysical and biochemical techniques demand a variety of electro-medical equipments and other physical facilities, some of which are costly and many difficult to procure. For the effective utilisation of such equipments, it is also essential to have a free flow of chemicals and reagents. It will, therefore, be necessary not only to provide well-trained and adequate staff for the different specialities in pathology but also to ensure the basic tools of investigation and research. It is perhaps unoecessary to give a list of equipments necessary for the various specialities that I have indicated. Most of these equipments are commoo to the various specialities and too well known to be enumerated.

Environment. The processes of learning and teaching can flourish only in a proper "academic climate." The success of any training programme in the department of pathology leans heavily on the standards achieved by clinical departments and on the scope and variety of investigations available for an adequate assessment of cases.

Well-organised group discussions, seminars and conferences emphasising a practical approach to biological problems are other essential requisites.

The availability of an adequate number of autopsies and well-documented biopsies along with other investigations embracing the various branches of pathology are necessary for a proper execution of any postgraduate teaching and training programme.

Emphasis has to be laid on categorising and defining topical problems which should form the basis of investigation and research in such departments. In the absence of knowledge, any attempt at fundamental research regarding the disease processes in any geographical area is ultimately going to be unproductive. The main objectives should be to develop and nurture a proper environment where the intimate relationship between the teachers and the taught can develop into a dynamic exchange of ideas and knowledge.

The success of any postgraduate department depends upon the co-ordinated, collateral and sequential growth of allied disciplines. The problems relating to "the cell, organism and milieu" and the basic technological methods provide a common bond. There is a good deal of overlapping of interests in the investigation of diseases, in the training and the research programmes of such allied disciplines.

It is necessary for a student of pathobiology to have basic knowledge regarding microbial

properties, to understand and appreciate the tissue reactions leading to structural and functional alterations. The student of microbiology should be equally interested in the morphologic and functional expressions and in the character of cell damage brought about by microbial factors. There are no clear frontiers between the independent disciplines of pathology and microbiology and their various specialities. On the other hand, there are many common bonds which should call for the closest cooperation between these disciplines in the training, teaching, and research programme of an institute. With the continued shortage of trained staff, and the difficulty in acquiring a sufficient number of essential equipments and other physical facilities, it may be more realistic to try and pool the resources for a common objective.

There can be no controversy regarding the independent and autonomous status of the department of microbiology. This should include the specialities of microbiology, immunology, virology and parasitology. Yet it may be desirable in the interest of training, investigation and research activities to bring these together on the sound basis of common scientific pursuit. A very good example is the set-up of the Postgraduate Medical School of London where the departments of microbiology, haematology, clinical biochemistry and pathology are separate and independent disciplines. To ensure effective coordination in training and research activities, the seniormost professor of any one of the above disciplines is designated as the director. Such coordination can be brought about without interfering with the autonomy of any one of the disciplines which have progressed enough to have independent status. However, it is necessary for all disciplines and departments to coordinate their activities and develop a proper climate of collaboration.

Technological methods and knowledge have made rapid strides and it is hardly possible to achieve much in isolation.

In the present stage of the development of our postgraduate institutes, every effort should be made to create a proper climate of collaborative efforts which will help in improving both the quality and the quantum of productive work.

BASIC AND SPECIFIC REQUIREMENTS OF A POSTGRADUATE STUDENT IN PATHOLOGY

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IN India, the postgraduate student of medicine has the opportunity of joining different courses of study in pathology. Some of these lead to a diploma in clinical pathology or bacteriology and others to basic medical sciences in general with specialisation in one or the other of the subjects. Facilities for the Master's degree in pathology also exist. Finally, one may work for a doctorate, viz. for M.D. or Ph.D. or D.Phil. in pathology. The basic and specific requirements for these courses vary, but there are certain aspects that are common to all.

For an assessment of the requirements of the postgraduate medical student, it is necessary to consider the student, particularly his basic training, and the facilities for his training which include the teacher, the equipment, the availability of material for study, etc. for the particular course of study.

It is generally agreed that for the diploma course and for the degree of M.Sc. in pathology, the student should be a medical graduate and have at least one year's hospital practice in a clinical subject. It is desirable to select students with good academic record and with a background of pathology. This qualification is adequate for the diploma courses which aim at imparting text-book knowledge and expect the student to accept it unreservedly. Even for the M.Sc. and M.D. in pathology, which entail writing a dissertation or a thesis, often a repetition of some older work, in addition to theoretical, practical and oral examinations, such qualifications are considered adequate.

But Ph.D. or D.Phil. in pathology requires, a radical reorientation. Here, the student is encouraged not to take anything for granted; he is required to study the published material critically. He should undertake newer forms of investigation with a view to contributing newer knowledge. In addition, he has to have adequate knowledge of pathology in general. For this category of postgraduate students, certain additional qualifications are necessary. The undergraduate career, particularly knowledge of English and performance in different medical examinations specially in pathology, have to be considered carefully. Only those possessing sound or at least a fair knowledge of English and having a good academic record should be selected for enrolment for the doctorate degree. It is often heartbreaking to see that a student is unable to record his observations in correct language or to express himself properly in a *viva voce*. The other difficulty noted is that, the student not having been taught elements of statistics in the undergraduate course, planning of experiments and critical assessment of observations are liable to be faulty unless checked by the professor.

This brings one to a brief consideration of undergraduate medical education and even of high school education. It is necessary to realise that the edifice of postgraduate education can only

be built on the sound base of undergraduate training. For those who want to tread the path of science and technology, competence in English forms an essential requisite. A firm foundation of a good or at least fair knowledge of this language has to be laid in the school-going age and a knowledge of literature and practice in writing essays have to be built up during the years of undergraduate education. Our undergraduate courses in the basic medical sciences are getting *overburdened with* details of newer knowledge. The student on getting through the examinations is liable to forget most of the things be had learnt by the time he reaches the postgraduate course, if not much earlier. An old-fashioned teacher would often wonder whether the undergraduate course should teach fundamentals only and leave out the trimmings of the newest knowledge. The latter can be acquired at the postgraduate level. Also, the teaching of pathology in the undergraduate course suffers from inadequate staff and teaching equipment and material in many medical colleges. The same holds good for other basic medical sciences as well. And the teaching of pathology has to be built up on the knowledge of normal anatomy and physiology and enlivened by sufficient clinical information.

It is now proposed to assess the requirements of a postgraduate student in pathology. For the diploma course, the primary necessity is, of course, the arrangement of teachers who are specialists in different subjects included in pathology. The institution where the courses are to be organised should provide adequate facilities for theoretical and practical training. The basic requirements for each student, such as the microscope, staining and other technical requisites, are to be provided as well as the routine equipment of an ordinary pathology laboratory. An dequate supply of specimens for the naked eye and histological examination has to be ensured and the teaching should be somewhat biased in favour of practical work.

One difficulty in the teaching of pathology that has to be faced in most teaching institutions in India is the paucity of autopsies. Biopsies and the specimens obtained during surgery provide useful material. But often the complete story of a fatal disease written in autopsy material is absent. Unless there is a radical change in the hospital laws and/or in the attitude of the people towards necropsies, the problem will remain. Attendance at post-mortem examinations carried out at the police morgues may help in learning the post-mortem technique and in noting the pathological changes in accidents and trauma (forensic pathology).

The next question to be discussed is of the teachers. For the diploma courses, the teachers should possess a postgraduate degree in pathology and have some aptitude for teaching. They should be practising pathologists, that is, they should examine pathological material from the hospitals and the autopsy rooms. The professors should be highly experienced teachers who would deal with the theoretical aspects of teaching and guiding the readers, lecturers and demonstrators in the teaching programme in the practical classes. It is not essential for every institution to provide all types of specialists. Visiting professors or lecturers should be invited to deal with special subjects for which facilities do not exist in the institution. It may be mentioned that this system has proved quite feasible and of great value.

The professor who would guide the postgraduates for the doctorate degree in pathology should himself be actively engaged in research and be a master of research methods. He should be a fairly senior worker with experience of teaching postgraduate classes. There should be adequate provision for assistance in the form of staff and research grants. The laboratory

under his care should have facilities for animal experimentation and for carrying out investigations by modern techniques.

The question of equipment is usually a constant headache for the departmental head as well as for the head of the institute. The requirements for diploma courses in pathology are mostly available in the country. But for better investigations and achieving technical excellence, it is necessary to import foreign instruments. Electronic apparatus, electron microscope, refrigerated centrifuge, cryostat, freeze drying apparatus, vacuum embedding bath of a reliable type, good quality microscope with photomicrographic attachment or equipment—these are a few of the common instruments of foreign manufacture that are necessary for a better quality of work. Stains and chemicals whether for routine purposes or for carrying out histochemical examination are not made in this country and will have to be imported. Finally, it has to be mentioned that it is not enough to have exotic or very modern research equipment; there must be adequately trained personnel to use these and to maintain these in good working order. A specialist in instruments, particularly in electronic apparatus, is a necessity for a research institution as also a workshop where minor repairs can be carried out and newly designed instruments of simple type fabricated.

In addition to the teaching staff for pathology and a well-equipped department, suitable for teaching and research, it is necessary for the postgraduate student to have a training in statistical methods as applied to medical research and a course of lectures on the English language. Also, there should be some facility for learning other foreign languages in the university where the training institute is situated.

A well-stocked library containing journals, monographs and text-books is a necessity for the postgraduate student. The library should be able to help with references on different subjects and arrange for photostat copies of rare journals. How to use the library and look up references is also another need of the postgraduate student.

Finally, the value of a well-organised pathological museum needs hardly be emphasised. A well-arranged museum with a qualified curator and assistants is almost equal in value to a supply of text-books and monographs.

The basic and specific requirements of the different categories of postgraduate students in pathology have been briefly discussed above. *But it is necessary to emphasise that, unless an institution or university has the requisite facilities for higher studies in pathology, it has no right to admit postgraduates.* The facilities have to be provided first and the recruitment of students should follow. Otherwise the quality of pathologists is bound to suffer.

DURATION OF TRAINING, METHODS OF TEACHING AND ASSESSMENT

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THIS paper deals with education in pathology for those medical graduates who wish to practise as pathologists, to teach the science in the universities, and to investigate pathological processes with the aid of techniques used in one or more basic sciences. A faculty member of a department of pathology in a medical college and teaching hospital is expected to combine within himself all the three qualities, albeit with varying degrees of competence in each. In an academic department, those who practise pathology in a service capacity only or engage themselves purely in research in pathology are few. It is not feasible, even if desirable, with our existing resources to have a number of pure scientist-pathologists and physician-pathologists. We have to rely for a long time to come on men who combine within themselves all the qualities listed above. There are many advantages for a research pathologist if he is also engaged in clinical pathology. This is the one way by which highly developed research techniques can be used for the pursuit of disease-oriented research, a long-felt need in this country.

Education in each of the areas listed above is a life-long process. Nevertheless, in the recruitment of junior faculty members, it becomes necessary to set an arbitrary standard of competence which must be demonstrated for admission to the faculty. The M.D. degree in pathology is such a standard in this country and forms the subject-matter of this paper, which I should like to examine from the points of view of duration of training, of methods of education and of assessment.

DURATION OF TRAINING

Education cannot be equated with time. The mere prolongation of the training period does not ensure better education. Students vary in their capacity to learn in a given unit of time. Duration of formal training is again linked up with the number and variety of opportunities available for the student to acquire the requisite knowledge and skills in pathology. These opportunities depend upon several factors:

(*i*) The number of autopsies, surgical and clinical pathology specimens and the extent to which these are utilised as effective teaching devices and learning exercises.

(*ii*) The number of competent senior teachers in the department who can exert influence on the student's mind through their attitudes and approaches which, as we all know, are intangible and defy precise definition. Nonetheless, they are principal factors in the success of the training programme. These factors when well developed can compensate for deficiencies in the quantum and variety of material available for study.

(iii) There should be an atmosphere of inquiry. A department of pathology which trains academic pathologists must have men who are not only competent interpreters of disease but who are also seriously engaged in the study of the phenomena of disease and possess deep knowledge of biology, immunology, biochemistry and biophysics. It is the function of an academic department of pathology to be concerned continuously with an understanding of the pathogenesis of disease processes. There should be opportunities for training in one or more fundamental techniques used in the study of disease, such as cytochemistry, electron microscopy, and differential centrifugation.

Barring a few exceptions, the minimum period required before being allowed to appear for the M.D. degree examination is two years in most universities in India. Considering the relatively small number of autopsies performed in a large number of teaching hospitals and the paucity of well-trained senior faculty members, opportunities for real learning in pathology at the postgraduate level are somewhat restricted. Under the circumstances, there is a general feeling that the period of formal training in pathology should be increased to three years after the student has spent a year in a clinical ward as a house physician or surgeon. It should be emphasised again that mere prolongation of the training period would be infructuous, unless steps are taken simultaneously to present varied and fruitful opportunities for learning during this period.

METHODS OF EDUCATION

It is here that the greatest revolution is needed in Indian medicine. Educational science tells us that the most effective and lasting way a student acquires knowledge is when he is an active learner rather than a passive recipient. In many institutions, an organised programme of education is not in existence and, when it is, it tends to be didactic, authoritarian, and a one-way phenomenon.

In setting up a meaningful educational programme, there are many devices, well-recognised and effective, which are employed with varying emphasis, in different parts of the world. These consist of lectures, demonstrations, seminars, group discussions, symposia, short courses, clinico-pathological conferences, journal clubs, etc. Each has its own value when properly used. It is not intended here to go into a discussion of their merits or demerits but rather to draw attention to some basic needs in this area in India.

(i) Daily and informal contact between the postgraduate students and senior faculty members built around daily problems is of paramount importance. Spontaneous and informal intellectual exchanges between the two are the essence of a lively educational programme.

(ii) Devolving responsibility on the student for a particular assignment is a well-known educative device which could be profitably used in teaching pathology at the postgraduate level. Subjects which lend themselves to this type of activity are clinical pathology, cytology, and surgical pathology. The term "in-service training" is much in vogue today. In this connection the only rider I would add is that there is too often a tendency for this to degenerate into a "pure service training programme." With most departments of pathology experiencing an acute shortage of faculty members, the danger of postgraduate students being used

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THIS paper deals with education in pathology for those medical graduates who wish to practise as pathologists, to teach the science in the universities, and to investigate pathological processes with the aid of techniques used in one or more basic sciences. A faculty member of a department of pathology in a medical college and teaching hospital is expected to combine within himself all the three qualities, albeit with varying degrees of competence in each. In an academic department, those who practise pathology in a service capacity only or engage themselves purely in research in pathology are few. It is not feasible, even if desirable, with our existing resources to have a number of pure scientist-pathologists and physician-pathologists. We have to rely for a long time to come on men who combine within themselves all the qualities listed above. There are many advantages for a research pathologist if he is also engaged in clinical pathology. This is the one way by which highly developed research techniques can be used for the pursuit of disease-oriented research, a long-felt need in this country.

Education in each of the areas listed above is a life-long process. Nevertheless, in the recruitment of junior faculty members, it becomes necessary to set an arbitrary standard of competence which must be demonstrated for admission to the faculty. The M.D. degree in pathology is such a standard in this country and forms the subject-matter of this paper, which I should like to examine from the points of view of duration of training, of methods of education and of assessment.

DURATION OF TRAINING

Education cannot be equated with time. The mere prolongation of the training period does not ensure better education. Students vary in their capacity to learn in a given unit of time. Duration of formal training is again linked up with the number and variety of opportunities available for the student to acquire the requisite knowledge and skills in pathology. These opportunities depend upon several factors:

(*i*) The number of autopsies, surgical and clinical pathology specimens and the extent to which these are utilised as effective teaching devices and learning exercises.

(*ii*) The number of competent senior teachers in the department who can exert influence on the student's mind through their attitudes and approaches which, as we all know, are intangible and defy precise definition. Nonetheless, they are principal factors in the success of the training programme. These factors when well developed can compensate for deficiencies in the quantum and variety of material available for study.

criticism, it is obvious that they cannot be dispensed with at present. They serve a useful purpose. What is needed is a realisation of what they can measure and what they cannot. The essay type and the multiple choice type are not mutually exclusive but complementary. Essay type questions test mental processes involved in recalling a mass of information on a given subject, arranging it logically and presenting it sequentially. A disadvantage of the system is that knowledge is tested at random which is a small fraction of what the student is expected to know. Multiple choice tests, on the other hand, evaluate only verbal recall of facts, over a wide range of the subject, and are thus more comprehensive in evaluating factual knowledge than the essay type. There is no evidence that the one or the other type is a better yardstick for assessing the actual professional competence of a student.

It is suggested that a combined approach consisting of the short essay type and the multiple choice type may be used for written examinations. Practical and oral examinations are considered necessary to evaluate the student's capacity to solve individual problems. But these are by no means exhaustive. There still remain certain attributes, such as judgement, individual character and attitudes, which are not testable at all and for which one has to rely on the judgement of the senior faculty member from whom the student received his training.

excessively, and even exclusively, for service load and routine teaching load is very real. There should he adequate supervision of the routine service performance of n student and, at each stage, he should, without prejudice to the responsibility he shoulders, be educated in this experience.

(*iii*) Clinicopathological conferences are useful devices of postgraduate education in pathology. There are many ways such conferences may be organised. The original Richard Cabot pattern as currently practised at the Massachusetts General Hospital has withstood the test of time and has been in practice regularly at the All India Institute of Medical Sciences since its inception. Its results have been rewarding. It facilitates logical and sequential mental processes in the analysis of a set of clinical phenomena, supported by laboratory data.

The success of such conferences depends upon the sense of discipline exhibited both by the clinician and the pathologist. It should be realised that the pathologist does not always know the final answer. It is not whether the clinical discusser arrives at the correct diagnosis or not that matters, but the manner in which be scientifically analyses the data. In the selection of cases, undue emphasis should not be laid on the exceptional features but rather on the usual and tbe natural history of disease.

Departments embarking on CPCs must bear in mind that considerable difficulty may be experienced in putting up suitable cases nt regular intervals. With the shortage of autopsies and the paucity of meaningful data (half-empty case sheets are distressingly common!), the selection of a suitable case can he a problem. Surgical biopsies can be used equally effectively if care is bestowed on the selection of suitable material.

(*iv*) Careful selection of topics chosen for discussion at inter-disciplinary seminars is a rewarding experience. The topics sbould be topical and cut across disciplinary barriers. Rheumatic fever and its sequelae is a good example.

(*v*) Research has a high premium in postgraduate education. The idea is to incorporate an intensive study of basic science in the training programme. The training should prepare the academic pathologist for researcb. He should be able to ask the right questions, to evaluate evidence critically, and to use modern methods in the study of disease.

Towards this end, all universities in India Insist that a postgraduate student should study a problem intensively with the aid of laboratory methods, evaluate existing knowledge on the problem critically, and incorporate the results of his study in the form of a thesis.

While in principle this requirement appears sound, all would agree that in practice it often fails to achieve the objectives. A thesis is often considered a chore and is, not rarely, devoid of intellectual content.

METHODS OF ASSESSMENT

Testing theoretical knowledge through written examinations is an essential part of all postgraduate examinations in medicine. Tbe essay type of question is still in vogue in this country, a legacy of the British system. There has been mucb debate as to the merits and demerits of the essay type versus the multiple cboice type. There are some who believe that examinations, however carefully devised, cannot evaluate educational accomplishment. While acceptiog tbis

criticism, it is obvious that they cannot be dispensed with at present. They serve a useful purpose. What is needed is a realisation of what they can measure and what they cannot. The essay type and the multiple choice type are not mutually exclusive but complementary. Essay type questions test mental processes involved in recalling a mass of information on a given subject, arranging it logically and presenting it sequentially. A disadvantage of the system is that knowledge is tested at random which is a small fraction of what the student is expected to know. Multiple choice tests, on the other hand, evaluate only verbal recall of facts, over a wide range of the subject, and are thus more comprehensive in evaluating factual knowledge than the essay type. There is no evidence that the one or the other type is a better yardstick for assessing the actual professional competence of a student.

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A COURSE IN EXPERIMENTAL PATHOLOGY FOR POSTGRADUATE STUDENTS

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THE objects of training postgraduate students in pathology are many, among which the provision of research workers and of future undergraduate teachers are important. Any course designed to train postgraduate students should take into account these two requirements.

A few years ago, at one of the postgraduate examinations in pathology, one of the candidates was asked to bleed a guinea-pig. The candidate was too frightened to handle the animal and refused to proceed further so that this aspect of the examination had to be abandoned. This incident gives a good indication of some of the lacunae in our training programme for postgraduate students, at least in some of our universities.

At present, in most of our universities, postgraduate training in pathology consists of nothing more than providing an opportunity to acquire more factual knowledge through books, coupled with a detailed training in routine techniques of the various branches of the subject. Thus, the main emphasis is on training in diagnostic pathology. There is hardly any opportunity for the students to get exposed to research techniques and methodology. Many of the postgraduate teachers argue that the students should be equipped well with the basic knowledge and that they can develop research aptitude later. But this hope is rarely realised. Many of the students who qualify are engaged as undergraduate teachers and they continue to employ the same old methods of teaching to which they were exposed and hardly make any attempt to change the old order of things. They become static and are mostly engrossed in the daily routine. Any one who has visited other countries will have no hesitation in accepting these changes. The research training that the residents get in those countries goes a long way in their future contribution as research workers. A pathologist never exposed to research methodology and experimental pathology either in his undergraduate career or during his postgraduate training can hardly be expected to develop an aptitude for research in his later life. The acute shortage of teachers to man a large number of medical schools ensures adequate placements for persons with postgraduate qualifications in basic sciences so that the incentive of competition is also absent. This is one of the reasons for the lack of any major contribution to medical research in this country.

Experimental pathology has always been an important tool in the study of diseases from the earliest times. With the rapid and enormous growth of the various branches of medicine and the introduction of newer techniques, the need for the use of experimental methods to investigate new problems and to re-investigate old ones has become great. The present trend even in undergraduate training is to acquaint the students with research methodology and incorporate

experimental pathology in their curriculum, Hence, it is all the more necessary that the postgraduate students, who are going to be teachers in the future, should be trained in these areas.

How is this to be achieved? Should a course in experimental pathology be prescribed and, if so, how should it be planned? In general, any course prescribed for the postgraduate students should form an integral part of their practical training. Training in experimental pathology can be provided in three ways.

First, where a number of postgraduate students are being trained, a systematic course in experimental pathology should be given. This should include information on breeding and care of laboratory animals, diseases of animals, handling of animals, administration of anaesthetic to animals and carrying out simple surgical procedures, design of experiments, use of simple methods of measurements and elements of statistics. This course can be common to all the postgraduate students in all the subjects, both basic and clinical. The students of pathology may be given an extended course incorporating the use of certain special techniques on animals, covering the fields of immunology, carcinogenesis, transplants, tissue and organ culture and use of radio isotopes. Such a course should include, besides lectures, actual practice of some of the techniques on experimental animals. The duration of the course may be about three months and it may be concurrent with the rest of the training.

Secondly, the postgraduate students should be encouraged to demonstrate to undergraduate classes simple animal experiments designed to reproduce pathological lesions. This will serve the dual purpose of creating a research bias in the undergraduate students and of training the postgraduate students in dynamic methods of teaching. At present, there are very few institutions which have introduced experimental pathology in their undergraduate curriculum. Lack of facilities and of adequate staff have been put forth as a plea by others for not resorting to this very valuable method of training; but this plea is untenable particularly in those institutions where postgraduate training is undertaken.

Thirdly, the system of submitting the thesis as a part requirement for the postgraduate degree in many of the universities can be put to good use by choosing subjects in such a way that the student has an opportunity to design a few experiments himself, make use of animals, and get acquainted with some research techniques. At present, in many of the universities, the "thesis" submitted is nothing but a dissertation dealing with a number of cases of a particular condition and the laboratory investigations carried out on them. The subjects allotted for theses should all have an experimental bias. In a well-equipped department staffed by experienced teachers, there should be no difficulty in implementing this.

A number of objections to implementing such a programme can be anticipated. The major plea will be lack of time, which brings us to the important question of the duration of postgraduate training. The two years' training required by most of the universities is quite inadequate. A minimum of three years should be prescribed, of which one year will be spent in learning experimental methods and preparing the thesis. In many universities, the postgraduate training in pathology at present includes training in microbiology with an equal emphasis on both. This practice should be discouraged and it is desirable that at the postgraduate level microbiology be treated as a separate speciality.

The second difficulty that may be encountered is lack of facilities by way of equipment and

laboratory animals. There are several institutions training postgraduate students in pathology where some of these basic needs are lacking. There can be no excuse to justify the recognition of such institutions as postgraduate training centres. It is for the authorities concerned to insist on the provision of such facilities and review periodically the suitability of an institution for imparting postgraduate training.

Any discussion on the training of postgraduate students in experimental pathology naturally leads to the question whether the qualifying examination should include a few experiments. The answer has to be in the affirmative since this will be one of the ways of ensuring that training in the branch is being given. At present, most of the examiners are satisfied by asking the candidate to bleed a rabbit or collect blood from a guinea-pig's heart. Since at most places the examination lasts from three to four days, it should be possible to ask the students to perform a few common acute experiments such as removal of an organ, ligature of vessels, making simple measurements on animals, demonstration of vascular phenomena, tissue transplants, etc.

The planning of a course in experimental pathology as detailed above and incorporation of the same as one of the essential requirements for the postgraduate examination should provide an opportunity to the postgraduate students to equip themselves properly for the tasks of the future research workers and teachers.

TEACHING OF PATHOLOGY TO THE POSTGRADUATES OF CLINICAL SCIENCES

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"Without a sound knowledge of the hidden processes of disease as revealed by pathology, the physician will flounder along in an aimless fashion, hitting now the malady and again the patient, he himself not knowing which."

—Osler.

THE requirements of the various universities for postgraduate examination in clinical subjects include some training in pathology. Unfortunately, such a training is lamentably lacking in postgraduate training programmes. The departments of pathology in this country have mostly concentrated on the training of young graduates who wish to adopt pathology as their career. We have neglected equally the more important task of making the future internees and surgeons pathology-minded. The first impact on a postgraduate student in clinical medicine is the teaching hospital which should really function as a graduate school. Here, the houseman finds pathologists, clinicians with a definite interest in pathology, those with only a mild interest or an academic curiosity, and finally those for whom pathology has no value. The future training of the internee in pathology will depend upon the professional pathologist, on the physicians appreciative of pathology, and on himself.

In the western countries this is a prerequisite for any postgraduate examination in clinical subjects. They require the candidate to work in the department of pathology for a period of 6 months to 1 year in an in-service programme. Recently, the Postgraduate Committee of the Medical Council of India has also made it mandatory for a postgraduate student of clinical subjects to work as a whole-time officer in the departments of basic medical sciences for a period of six months.

Therefore, the two questions that at once arise are: (1) Is training in pathology essential in clinical medicine? (2) If so, where should such a training be given and what should be its aim?

Our primary aim in teaching pathology to postgraduates of clinical subjects is not to produce expert pathologists but rather good general practitioners equipped to visualise the underlying pathological changes and to fully appreciate the clinical course of the disease.

There is no denying the fact that the pathology training is essential to the postgraduates, and is likely to produce a clinician who will continue to contribute to medicine as an art, who will effectively undertake medical research, and who will develop an outlook of critical curiosity which would enable him to tackle fresh problems in medicine. A clinician trained thus in his formative years has a background of unquestioned value in the practice of medicine.

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has a more ready access to material studied than is true of his clinical colleagues, obstruct the attainment of his idea." Such conditions offer an excellent opportunity to the pathologist to impress his young clinicians and make them pathology-minded.

This integrated approach to the training of pathology between the departments of clinical medicine and pathology can be further supplemented by the in-service training programme in the department of pathology. The department should provide continued opportunities for whole-time jobs for the postgraduates of clinical sciences. These graduates should be posted in the various laboratories providing facilities for investigations as applicable to their careers. For example, a postgraduate who is preparing for a career in surgery should be given more training in surgical pathology, while a postgraduate aiming at clinical medicine should be given more training in clinical pathology. These postgraduates should be allowed to deal with the surgical material and to perform the autopsies, and to correlate the lesion of the clinical aspects of the case. They should be encouraged to participate effectively in group discussions and the presentation of the findings to the surgical and medical staff. The organisation of such a programme for teaching pathology will depend upon the facilities available in different institutions.

Another important addition to the curriculum could be made by providing elective time in the rotating housemanship, and clinical pathology could be one of the departments of rotation. In S. N. Medical College, Agra, clinical pathology is one of the elective departments whereby the duration of rotating housemanship is two months.

I would now like to give an outline of the principles of such a training programme which we have usefully applied in our institution. First, the worker should personally examine and report upon fresh surgical material. Secondly, he should perform the autopsies, study and report the gross and microscopic findings and present the same at the clinico-pathological conferences. Thirdly, he should be encouraged to take active part in the surgico-pathological conferences where the operated material is discussed. He should be encouraged to present the clinical history and details of operation correlating them with their morphological changes in the tissues. Fourthly, he should be held responsible for the departmental work as much as possible in the various laboratories. Fifthly, he should be given a definite assignment in the training of experimental pathology. This would help him to learn experimental techniques in education and infuse in him a spirit of self-education. Finally, he may be engaged in some research projects either independently or with the senior staff.

Before I finish, I feel it would be useful to mention that pathology has to play an important part in the continued education of a doctor. I should like to point out that it is not just enough for a postgraduate to be pathology-minded, but to see that his interest in pathology continues. During his general practice he should be encouraged to attend the departmental conferences and send material from his patients for investigative purposes. How much interest is sustained will depend upon the facilities which are given to him for the investigation of his patients or for the interpretation of the pathological findings. I feel that the great responsibility to make pathology secure in clinical practice rests on the pathologist himself. I would quote Playing Wright: "I hope that those who have to guide the growth of pathology in our universities will appreciate that its departments are the main market for the exchange of knowledge and ideas between those who work in fundamental science and those who work in clinical medicine and surgery. When based broadly, on an academic foundation, no subject holds greater potentialities."

The training programme for prospective teachers has to be oriented keeping in view that a teacher has to perform the dual role of teaching and research. If more and more research is to be carried out in our country, the teacher has to train more and more people in how to carry it out. Therefore, a prospective teacher must be thoroughly trained in research methodology as also in the capacity to pursue research projects independently. Side by side he is also required to be fairly well educated in academic and technical activities of his speciality. His training programme has to be a long one extending over 3 to 4 years, and utmost care has to be exercised in the selection of candidates for training as teachers. Only those medical graduates who have shown exceptional ability should be assigned to such training.

In the case of a postgraduate who intends to pursue a research career, the problem is not so difficult. He has to have a broadbased training in the speciality followed by a period of intensive research work during which he should be able to develop the confidence of independently investigating research problems.

There are certain essential requirements which must be met before a department or a medical college can provide adequate facilities for research training to the postgraduates. The foremost among these is a well-qualified and experienced staff to organize and supervise such a training programme. A reasonable quantity of modern equipment and apparatus with a generous provision of funds to carry out experimental work and facilities for replacement and repair of apparatus are other essential requirements. A well-stocked library is no doubt of great importance without which little training can be given. With the rapid expansion of medical education and rapid increase in the number of medical colleges in our country during the last decade, such facilities are often lacking in many colleges. It is, therefore, of vital importance for the future development of medical research and education in our country to exercise vigilence over colleges intending to undertake postgraduate training programmes. Further, as the research training programme requires constant and close supervision of the student, it is necessary to avoid overcrowding as far as possible. In my opinion it is unfair for any supervisor to supervise more than 4 to 5 students at any one time.

It might be worth while to examine briefly the pattern of postgraduate training in pathology as it obtains at present in our country. The training provided to postgraduates in our country seeks to award diploma and M.D., M.Sc. and Ph.D. degrees in pathology. The pattern of training as also the requirements of research training vary from college to college.

The diploma course in pathology is usually for a period of 12 months during which the training programme usually does not include any research work. It is necessary that at this stage of training the student should be given an idea of research methodology, planning of experiments and critical evaluation of scientific data. Such a programme will not require the candidate to carry out extensive research by himself.

But the candidates doing M.D. and M.Sc. are required to carry out research work which later on they submit as their thesis. The thesis is usually evaluated by two external and one internal examiners and if it is approved then a candidate is allowed to appear in theory and practical examinations, on the basis of which he is awarded the degree. The usual period of study for these degrees is two years although in many colleges the candidates are not on the roll and, therefore, there is no regular training programme. Neither for training a candidate

RESEARCH TRAINING IN PATHOLOGY : THESIS AS A REQUIREMENT FOR THE POSTGRADUATE DEGREE

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ADVANCEMENT of knowledge is an important function of medical colleges and, therefore, training in research forms an important part of medical education. It is now generally recognised that instruction of postgraduate students in the principles of scientific accuracy and observation and development of inquisitiveness in the understanding of the diseased states is of utmost importance. Soon after Independence, there has been a growing realisation in the medical colleges of our country of the importance of research in medical education and such activity has considerably increased in some of the educational institutes. Research now appears to be on the forefront and there is even a tendency at places to attach undue importance to research work carried out by postgraduates. Such developments need to be checked if research has to play a significant part, which it should, in the medical education of our country.

The pattern of research training for postgraduates in pathology can be easily stated if one is clear about the objectives of postgraduate education. In the present state of medical profession, I think, there are mainly three objectives of postgraduate education.

(1) To provide for specialised training in the subject so that the graduates may be able successfully to practise as pathologists.

(2) To provide requisite training of a high academic standard with a view to training graduates for teaching assignments.

(3) Organisation of training programme with particular emphasis on research with the object of producing research workers.

What should be the nature of research training in order that it may fit in with these objectives? It is apparent that both the nature as also the extent of training would vary in each instance. Thus, in the case of the specialist, during the postgraduate period the emphasis is more on vocational and technical training and apprenticeship under the supervision of the teacher. At this stage all that is necessary is merely an introduction to the nature of research activity and, in my opinion, it would be wrong if he is made to spend much time on research. It is true that every graduate should develop a critical faculty and that research surely helps many to do so. This, however, does not imply that such an outlook cannot be created unless the student carries out a research project himself. It seems wrong to demand, for educational reasons, that a postgraduate should spend time on research if he cannot make good use of it or enjoy it.

EXTENT AND SCOPE OF TRAINING IN HAEMATOLOGY FOR POSTGRADUATES IN PATHOLOGY

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INTRODUCTION

THE past decade has witnessed a series of changes in medical education all over the world. A general sense of dissatisfaction with the organisation of postgraduate medical training has led to an increasing concern to define the qualifications, responsibilities, and educational needs of the future medical teacher and research worker. Reports on medical education reflect the many ways in which the medical schools in the West have been attempting to adjust their programmes of postgraduate teaching to the new climate of change. Though it is a good augury that in this country we have started thinking about the problem, any attempt to prescribe programmes developed and practised in other countries, except in the most general terms, would be unwise. Each institution will have to evolve its own technique of training for the postgraduate students, depending much upon the local circumstances. It is, therefore, advantageous to consider at the beginning what our problems of training in haematology are before proceeding to discuss its scope and extent.

PRESENT POSITION

Nearly all the medical colleges in India that undertake postgraduate teaching in pathology aim at a comprehensive training which includes, besides tissue-pathology, also bacteriology, immunology, haematology and chemical pathology. Only recently has microbiology separated out from pathology in some of the institutions. I am not aware of a separate department of haematology existing in any of our medical colleges so far. It forms a part of the department of pathology where the haematologic work of the rest of the hospital is done in the clinical pathology laboratory attached to the hospital. A haematologist, in India today, is almost always a pathologist who has spent his professional life in a laboratory investigating patients of blood disorders. At many centres this specialist also undertakes work in other branches of pathology, like chemical pathology or Blood Bank. As a rule, the haematologist investigates the patients of blood diseases in complete isolation and, therefore, he seldom consults his clinical colleague.

FUNCTIONS OF A TRAINED HAEMATOLOGIST

Before defining the extent to which a postgraduate student of pathology should receive training in haematology, it is necessary to know what we wish to make of these students by the time they finish the training. Although the scope of work of a pathologist who is trained as a

for teaching assignment nor for research career is such a situation suitable The thesis is more or less a passport for a candidate as it enables him to appear in the final examination As he is in a hurry to complete the thesis he cares little to give his thesis a scientific orientation Besides the thesis is written at a time when he knows little of the various technic used in pathology A more fruitful result can be obtained if the practical and theory examinations are held two years after the vocational and practical training programme in pathology If the candidate qualifies in these examinations he should then be asked to pursue research and submit his thesis [1]

Some universities in India have lately introduced Ph D in pathology which is a healthy development towards the training of future research workers The rules are however not very explicit about the training programme or about the admission requirements Candidates should be admitted for Ph D degree only if they hold a postgraduate diploma or degree in pathology With the vast expansion in knowledge and the introduction of numerous elaborate technical procedures it is essential that a candidate who intends to embark on a research programme which is likely to make original contribution to the existing knowledge on the subject should be well versed with the basic fundamentals of the speciality It is only then that he can be expected to fruitfully carry on such an investigation to completion Though the award of the Ph D degree is mainly based on the thesis it is essential that such candidates during the period of their research training are given both vocational and practical training on research methodology

besides participating in the undergraduate teaching, in departmental seminars, in clinicopathologic conferences and in autopsy discussions.

The second year of the training should be spent in both the departments of pathology and of medicine. A practical and convenient way would be for the students to spend the mornings in the hospital ward for studying the patients. Complete laboratory work of blood dyscrasias of the patients could be undertaken by the students at this time. This would give them a total perspective of the disease and afford an opportunity for learning not only the techniques that form an essential part of haematology training, but also to correlate the biochemical, pathologic and pharmacologic mechanisms. Attendance at ward rounds and participation in bedside clinical conferences would stress the special relationship of haematology to clinical medicine. A suitable research problem, to form the subject of the thesis towards the postgraduate degree, could also be worked out during this period.

The whole of the third year should be assigned to an intensive study of the speciality. This could take the form of examination of blood, bone marrow, splenic and lymphnode punctures in relation to clinical and biochemical changes that frequently find specific morphologic expression in the biopsy material. Seminars on the basis of suitably selected reading assignments could be designed in order to cover the various fields of haematology. Initiation into experimental haematology by devising simple animal experiments, such as (*a*) production of haemolytic anaemia, (*b*) administration of a folic acid antagonist, (*c*) production of sterile abscess, (*d*) production of hepatic insufficiency, can give the students an insight into the basic mechanism of some of these processes. Exposure to experimental work will not only bring the student in contact with the material studied, but would enable him to develop an appreciation of the method of science and of interpretation of experimental data. It would train him to observe, think and perform experiments.

EXPECTED RESULTS

After this, it would be reasonable to expect from the students (*a*) an adequate amount of knowledge to carry out by themselves and supervise simple haematological techniques, (*b*) to interpret the morphology of the biopsy material like blood, bone marrow and lymph nodes, (*c*) an understanding of the fundamentals of blood clotting and its disorders together with an ability to carry out investigations, and (*d*) an understanding of at least the principles involved in some of the more modern investigational techniques, especially with reference to radioisotope studies.

BACKGROUND PREPARATION DIFFICULTIES

In outlining the scope and extent of training in haematology, I am very conscious of the difficulties likely to be faced in its implementation. It is absolutely necessary to have adequate and qualified staff. Special equipment is another prerequisite. It may appear wild thinking to many, but the quality of training would be far more sound if one of the staff in the section of haematology is a physician holding a joint appointment in the departments of pathology and medicine with some beds under his complete charge in the hospital. For reasons beyond our control, this may be difficult to achieve at many places. In that event the responsibility for the

haematologist, or what may be called a laboratory haematologist, will vary with the circumstances, to my mind it could be broadly divided into three categories:

1. Organisation and supervision of routine hospital haematology service.
2. Detailed investigation of patients of blood dyscrasias.
3. Teaching and research.

In outlining the above duties, I have been guided by the fact that in this country, at least for a number of years to come, the training in haematology would be the responsibility of the department of pathology. Many would seriously question this arrangement and doubt whether an adequate training in haematology is possible in a department of pathology. Haematology, no doubt, has deeper roots in clinical medicine and, in recent years, the haematologist has come to share more and more with the physician in the care of the patient.

I find it difficult to accept the idea that the haematologist should have beds in the hospital under his complete charge. This should still be the responsibility of the physician who can view the patient as a whole, and not as an isolated haematologic problem. Where is the blood disease that does not affect the rest of the human systems? The crux of the problem, to put it in Dacie's words, then is "how can the laboratory haematologist's knowledge and experience and his natural desire for some control over the investigations and treatment of patients be reconciled with the undoubted right of the clinicians to have full charge and responsibility for patients in their care?" There is no easy solution to this problem. It only emphasises the need for close collaboration between the departments of pathology and medicine, if the postgraduate training in haematology is to be effective.

PATTERN OF TRAINING AND PLACEMENT

The other question that may be raised is whether it is feasible for a postgraduate student of pathology who is also undergoing simultaneous training in its various sub-specialities like tissue-pathology and chemical pathology, to say nothing of microbiology, to acquire sufficient knowledge in haematology. The answer is obviously "no." It is agreed by all that it is impossible to acquaint the students with all the facts of any one speciality or, for that matter, of a sub-speciality. An ever-increasing amount of knowledge in the field on the one hand and nonavailability of increased curricular time on the other make this difficult to achieve. It is no longer possible to aim at a comprehensive training in pathology that would embrace all its sub-specialities. Hence, our aim should be to lay emphasis on one of the sub-specialities against the background of general training in pathology. In this way we may have pathologists trained primarily as histopathologists or haematologists or chemical-pathologists, each to fulfil his own place in the broad discipline of pathology.

Having thus defined my premise, I would detail the extent of training in haematology that I consider essential for a postgraduate student of pathology. The period of training should extend for a minimum of three years after the date of registration. The first year should be spent in the various sections of the department of pathology during which time the students should fully share in the routine work of the respective sections of the department,

TEACHING OF CLINICAL PATHOLOGY TO POSTGRADUATES

DR. D. N. GUPTA

IT would be appropriate to define clinical pathology before considering the necessity of teaching it to the postgraduates. Dyke defines clinical pathology as "that field of medical activity covering the application through the instrumentality of the hospital laboratory of its basic sciences to the clinical practice of medicine both in the diagnosis and in the treatment of disease." Its purpose thus is strictly practical and its immediate aim is the care of the patient. As a clinical pathologist, one is required to provide definite answers to specific questions regarding the patient's illness. Does the patient have diabetes? Is the patient's anaemia due to iron deficiency? Does the child's fever, headache and neck rigidity signify meningococcal meningitis? Are the patient's enlarged lymphnodes in the neck an evidence of a malignant disease? When the pathologist provides answers to questions such as these he is functioning as a clinical consultant. This is the sense in which the term clinical pathology is used in this paper.

Because today's research becomes tomorrow's routine, there is an ever-expanding scope for clinical pathology. More tests and still more tests seems to be the order of the day and hence the expansion is indefinite. Unlike specialities like venereology, tuberculosis infectious diseases etc., which have shrunk or are shrinking as a result of the contributions of research, the opposite is the prospect with clinical pathology. With increasing longevity, screening of healthy persons will become a routine. This again will mean more tests and cytology and biopsy will be in greater demand.

Laboratory tests increase by approximately 50 per cent every decade. This increase means that no single individual can hope to become an expert in all aspects of clinical pathology. The organisation of a service in clinical pathology now demands a team composed of individuals with special knowledge of the disciplines concerned. The traditional subdivision of this discipline are haematology, chemical pathology, clinical bacteriology and morbid anatomy or surgical pathology. Variations in the pattern of the set-up exist in various institutions and no rigid criteria can be laid down. It is immaterial whether the parent department of microbiology, chemical pathology and morbid anatomy are separate entities or a combined department. It is much more essential that the postgraduate is exposed to the application of the basic principles of these sciences as well as to the problems of the patients in the wards or in their homes.

As mentioned above, clinical pathology is a heterogeneous field and its teaching to the postgraduates is a multifaceted problem. I shall, therefore, confine myself only to the following three aspects:

(a) Role of teaching hospital in postgraduate training in clinical pathology.
(b) Case method of study of clinical pathology.
(c) Pathology as an internship programme.

organisation and execution of haematology training should be delegated to a committee, one member of which should be from the department of medicine. In this way will a postgraduate of pathology be trained as a haematologist with due emphasis on its clinical aspect.

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approach to medicine. For these reasons, a proper blend of the various teaching methods would be necessary. For the teaching of clinical pathology, CPC type or a case method type of teaching has obvious advantages. Unfortunately, in actual practice, in CPCs there is an emphasis on rare diseases or upon rare manifestations of common diseases. There is an element of guessing and an earnest attempt to come as near the diagnosis as possible. Since it is the pathologist who has the last word in CPCs, it is likely to give him an undue sense of importance regarding his own observations and conclusions and a tendency to minimise the clinicians' difficulties and points of views. A modification of this method of teaching can be used to impress upon the postgraduates the need for an integrated approach to the subject. A group of 5-10 students may be given printed notes giving clinical history, X-ray and laboratory findings including surgical pathology or autopsy materials if any. Along with these notes a list of questions of pertinent enquiry and important references in the literature on the subject may also be given. About a week later, a round table conference can be organised lasting for 1 to 2 hours in which physicians, surgeons, pathologists and, if possible, biochemists and bacteriologists should participate. The case then may be discussed by one of the postgraduate students who would review the relevant literature and give his opinion as to the course of the disease and mistakes, if any, committed by the clinicians or the investigative departments.

Such a method of case study laying stress on the common diseases provides an opportunity for a full and frank discussion on the why and wherefore of a problem giving at the same time an integrated approach which is so very essential in the understanding of a disease. Pathology must always be oriented towards clinical medicine. Proficiency in this subject can no more be achieved in the isolation of the laboratory or research institute than can surgical judgement be acquired in the dissection hall or experimental surgical laboratory. We need constant reference to the day-to-day routine of the hospital to give breadth and depth to our teaching, research, and practice. Without this source of new ideas and this testing place for old ideas the dimensions of our speciality tend to become shallow and narrow.

(C) PATHOLOGY AS AN INTERNSHIP PROGRAMME

The rotation of the postgraduates through the various subdivisions of clinical pathology has already been referred to. The importance of such an in-service training programme cannot be overemphasised as it is firmly believed that a pathologist cannot be trained without doing the work of a pathologist—of course under guidance and assistance at a supervisory level.

Some of the hospitals feel tempted to become teaching hospitals under the mistaken belief that they would get extra hands at no cost. This is not only a wrong assumption but positively a dangerous one What such hospitals need is not in-service trainees, but assistant pathologists. It is to be emphasised that the establishment of a residency training programme does not decrease the need for senior staff, but actually increases it. For example, after an autopsy, a senior member should sit down with the postgraduate residents and go over the organs. He should then direct them to read the relevant literature for further study. Later, the microscopic slides should be reviewed and possibly some more relevant literature studied. In short, the senior pathologist does as much work at the autopsy as if he had done it himself. The same applies to surgical specimens and many bacteriological and chemical determinations.

(A) ROLE OF TEACHING HOSPITAL

All hospitals have one basic objective and that is to offer patient-care and community service. The teaching hospital, in addition, must provide a proper climate for teaching (undergraduates, postgraduates, fellows, residents, etc.) and research. There must be a proper synthesis of these three functions, and to place any one of these above the other is to lose sight of the ultimate objective. Let these objectives be made complementary and not competitive. Unfortunately in our country at present the conditions are far from what they should be. In many of the hospitals which are attached to medical colleges, patient-care is regarded as service load and hence merely tolerated as a necessary evil. Trainees working in such an atmosphere do not imbibe the kind of community responsibility that the public expects of medical men. There are also hospitals where little or no attention is paid to teaching or research and the attention is focussed on either quick turnover of the patients or on undue economy in drugs, dressings and staff. Obviously, such institutions are not conducive to teaching or research.

The department of clinical pathology in any teaching hospital should serve as a means of integrating all the clinical activities of the hospital. Its influence can go beyond the four walls of the hospital to all the practitioners in the area dependent on the hospital. It is in this department that all the basic scientific disciplines are brought into relation with clinical sciences. It is here that the clinicians get acquainted with the procedures they increasingly demand, and learn to assess the significance of the results upon which they become increasingly dependent. In the face of the present developments it seems inevitable that the rational practice of medicine in future must come to depend more and more upon the training received by the medical student (whether undergraduate or postgraduate) in clinical pathology and the extent to which its influence permeates the whole of the hospital.

It would be generally accepted that different kinds of training are required to produce a diversity of experts required in this discipline. A majority of the postgraduates would like to take positions in the teaching hospitals with opportunities in teaching and research. Some would become general practitioners of laboratory medicine and a few would take to research careers. The training in clinical pathology is desirable for all the three categories, especially for the first two. It is suggested that the training period should be three years. For practitioners of laboratory medicine, rotation in the subdivisions of the discipline like surgical pathology, autopsy, chemical pathology, clinical bacteriology and haematology, etc. should occupy most of the training time. For those going to join teaching hospitals, it would be advantageous to spend a part of this time on a research problem and in any sub-speciality like cytology, immunopathology, etc. For those who are going to take up a research career, a preliminary rotation is made through all the subdivisions followed by the bulk of the time to be spent in research activity. However, there should be a great deal of elasticity in the curriculum to suit local facilities.

(B) CASE METHOD OF STUDY OF CLINICAL PATHOLOGY

Each method of teaching has its characteristics and consequently its advocates. For example, a formal lecture is as inspiring as an informal preceptorial with its intimate student-teacher relationship. Similarly, the clinico-pathological conferences bring out the integrative

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PATHOLOGIST AND CONTINUATION OF MEDICAL EDUCATION

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EDUCATION is a continuous process and it must not be confused with giving degrees. We must realise that formal teaching only lays the foundations on which the superstructure of medical knowledge is to be raised, which requires both experience and critical observation. Such an education begins mainly after formal education is over. "Education for medicine must move from objectives placing such great emphasis upon the acquisition of information toward objectives more effectively promoting the ability to select, organize, and evaluate information in a way that will stimulate as well as satisfy curiosity and also foster the kind of clinical perception which the judgement of learned profession will increasingly require" (Darley, 1962). Today medical research is developing at an unbelievably fast pace. With more and more institutions devoting themselves to whole-time research and with the increasing consciousness of the value of investigative work in the pursuit of knowledge, there has been a "crescendo outpouring" of information. "Publish or perish seems as physiological an urge as "reproduce or die" (Dryer, 1962), and this explains why it is extremely difficult for even whole-time teachers and research men, let alone general practitioners, to keep abreast of what is going on in their own respective fields.

Most conferences on medical education debate on how much to give and how to give what to the undergraduates and postgraduates. If the practice of medicine and the art of healing has to be determined by a physician's education in the true sense of the word, one must admit that a woeful gulf exists between what one knows and what one practises. "If education truly means learning all one's life, as Plato so wisely insisted it must, then the dividing lines we draw between undergraduate, graduate and postgraduate medical education are institutional, not personal, boundaries" (Dryer, 1962). It is, therefore, logical that we should pause to consider whether our task finishes after the award of degrees to the student, and if not, what should be done under the present circumstances of fast-increasing knowledge.

The continuing education of a physician has, unfortunately, to compete with the pharmaceutical industry with its vast resources and unqualified roving teachers in the garb of agents who, in the process of extolling the virtues of their products, also do their share of brainwashing by percolating some of the none-too-useful information that they may have. Small wonder, steroid hormones have been seized upon by medical practitioners for producing magic cures that naturally enhance their prestige in the eyes of the patient, but the ill-effects that result from such a regimen in the long run are laid at the door of fate. Antibiotics which came as the biggest advance in the history of therapeutics in recent years have, to some extent, become a scourge in medical practice on account of their indiscriminate use. The treatment of even common ailments in general practice has come to be more symptomatic than curative, aimed at bringing a quick,

albiet lesser, relief in the long run. One of the reasons seems to be that the pathophysiological basis of a disease, which explains the symptoms of the patient and the course of the disease, is often all but forgotten. Old beliefs, with the passage of time, have hardened into curious incongruities which have no justification to exist any more in modern medical practice. Treating all anaemias with liver extract and iron, any liver disease with methionine or liver extract, are common examples seen in everyday practice. To the lay public a pathologist unfortunately has come to imply a person who is merely a tool in the process of diagnosis—one who reports on stool, urine and blood samples to support or guide a clinician's diagnosis. It is needless to emphasise that such simple laboratory procedures are no longer considered the function of a specialist and many institutions even shun the use of the term "clinical pathologist." Pathology, in the context of true education, is the science which bridges the gulf between abstract metabolic phenomena at molecular level and clinical medicine, that gives a tangible explanation of the basis of disease. In that sense, no education, to a practitioner, is complete without a pathologist who in fact has a pivotal role to play.

What, therefore, has the pathologist to contribute to the process of continuing education which begins after the formal award of the graduate degree? One may discuss pathological education in two phases:

1. During the training period of the resident in clinical sciences.
2. During one's career as a general practitioner or a specialist.

That some education in pathology as a part of the formal training of a resident working for a clinical postgraduate degree is essential, is evident from the fact that in practically every examination, including anaesthesiology, the ritual of showing pathology specimens to the candidate is performed. I call it a ritual because very little attention is paid to this subject during the period of training. I should not like to discuss this topic in my paper as this might be a subject for detailed analysis in the training parts of different specialities.

What is neglected more in the continuing education is the role of the pathologist after the struggle for degrees is over. Therefore, keeping both "non-institutional" physicians and "institutional" physicians in mind, I should like to emphasise that our aim should be to bring the knowledge to the door of the practising physician in a form suited to the needs of the practitioners. Advances in medical research have to be brought to him in an intelligible, applied form rather than by displaying the minutia. This can be done in several forms.

1. Practitioners' Conference

A regular periodical session may be arranged in the medical teaching centres. It shall be a part of their regular duty to arrange conferences on the lines of a panel discussion, with the pathologist as the pivotal figure. In informal sessions of this nature, discussions may be kept at an even keel and the morals derived must be such as may be of use in everyday application to the physician. Such sessions are in fact arranged periodically by the Indian Medical Association and are known to be useful to the practitioners.

2. Clinical Pathological Conference

This is recognised as the most useful single exercise in any teaching centre. An autopsied or surgically operated case that has been analysed well is generally selected. A clinician discusses the pros and cons of the differential diagnosis in the light of available clinical and laboratory data. The pathologist in the end reveals the morphological findings and follows it up by an explanation of clinical phenomena observed in the case. A single exercise of this kind, which is a regular feature in some centres, is known to attract the largest number of practitioners from the city.

3. Visits by Teams

A selected team from a medical centre, which is capable of talking on one or two selected topics in a correlated manner, may pay periodic visits to different parts of the State on specified dates. During these visits, they may hold panel discussions and demonstrations or sometimes even give lectures based on their own experience. The idea is that, since a practising physician does not have much time to attend exercises in the teaching centres, educational facilities may be made available to him outside the immediate orbit of a medical college. Visits by teams of experts and talks on endemic disease problems, such as goitre, bladder calculus, yaws, or diseases of malnutrition, will be of immense benefit from both preventive and curative viewpoints.

4 Formal Courses

Periodic courses on selected topics may be arranged depending on the interests of the pathologist and the amount of material available in a particular centre. Courses on interpretation of blood smear and bone marrow, interpretation of electrocardiogram, exfoliative cytologic diagnosis and others may interest not only the pathologist but also the internist.

5. Correspondence Courses

This type of course has been successfully tried out at the University of Kansas School of Medicine which has a department specially meant for this purpose. The course is designed for self-education by providing interesting case histories, inviting answers to selected questions and then sending the corrected answers which may pertain to all aspects of the patient's clinical course.

It should be realised that the implementation of the above proposals needs resources as well as qualified staff and, therefore, it may not be possible for the newer colleges to undertake them immediately. It is, however, felt that unless a beginning is made, at least in some of the established institutions, we would continue to neglect the education of the physician, which is important if we have to improve or even preserve the quality of service provided by the medical profession.

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BACTERIOLOGY AND PARASITOLOGY FOR A POSTGRADUATE IN PATHOLOGY

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IN deciding what should be the extent and content of the knowledge of a particular specialist, it is essential first of all to decide what the specialist is going to be: his field of work, the extent, nature and scope of his work. Unless we know what is expected of him, it would not be right to formulate what he is expected to know. Hence, the first question to be decided is what will be the function or functions of a person who has got a postgraduate degree in pathology. In our country, we can broadly divide the medical colleges into two types: those with separate departments of pathology and bacteriology and those with composite departments of pathology and bacteriology. In such areas where there are separate departments of pathology and bacteriology, the head of the department of bacteriology or any person above the level of a tutor is expected to possess a postgraduate degree in bacteriology (bacteriology here is used loosely for microbiology as today bacteriology is a multi-disciplined speciality including systematic and applied bacteriology, immunology, virology, medical mycology and parasitology). In these places the professor of pathology is solely and wholly in charge of the pathology department and in many cases of the clinical pathology department of the hospital as well. In the other areas where there are composite departments, where pathological and bacteriological work are done in the same department, the head of the department in ninety per cent of the cases is a person with a postgraduate degree in pathology. Occasionally, one may find a person with a postgraduate degree in bacteriology heading the department. I am not aware of any such person. Coming to postgraduate courses offered in pathology, here also there is considerable variation in the content and standards set for the students' knowledge in bacteriology. We have, on the one hand, colleges with separate postgraduate courses in pathology and bacteriology as in the Madras University colleges, Andhra University colleges, and in the upgraded departments of pathology and bacteriology at Visakhapatnam. Here, the student is given an M.D. in pathology with bacteriology as his subsidiary, or an M.D. in bacteriology with pathology as his subsidiary. In Lucknow, they offer an M.D. in pathology only, but the candidate is expected to know both the subjects equally well. The candidate takes either bacteriology or pathology as a subject for his thesis. In other places, like the University of Delhi, All-India Institute of Medical Sciences, candidates doing pathology for their M.D. degree have to know some bacteriology but the course of study seems to vary from institution to institution and is vaguely defined. Having, thus, brought out what to my knowledge are the conditions existing in our country, let me proceed to lay down what I feel should be our norm. If an M.D. in pathology is expected to head a combined department of pathology and bacteriology with the responsibility of undertaking bacteriological work

as well, or if he has the ultimate responsibility for the correctness of the report emanating from his laboratory and if he has the responsibility to train candidates for M.D. in pathology including bacteriology, then the person taking an M.D. degree in pathology must have more than a working knowledge, or rather a sound knowledge of bacteriology as well. Today the sciences of pathology and microbiology are so vast and varied and divided into a number of disciplines, each of a major stature, that it will be futile to expect any one to have a comprehensive knowledge of both bacteriology and pathology, let alone in one of the major fields. Therefore, we have to compromise, but unfortunately it seldom serves the purpose. But, in the case of a person heading a combined department, it should be compulsory, or rather, to put it in a noncontroversial way, if there is a fully qualified bacteriologist in his department, an M.D. in pathology need have only a sound knowledge in bacteriology equivalent to the level possessed by an undergraduate of a very high quality, say, a first class student, and in addition he should have done with his own hands most of the exercises in bacteriology, such as study of cultures, isolation of organisms, examination of pathological specimens, performance of routine serological and other bacteriological techniques. In a good medical college, with a well-equipped and properly staffed department of bacteriology, all those facilities are rendered available even for an undergraduate. More than that we need not expect in the case of a candidate for M.D. in pathology. We may therefore include bacteriology as a subject in Part I of M.D. just as for clinical subjects they have a Part I in basic sciences or for fellowship a preliminary examination in basic medical sciences. I do agree that there is no scope for a practical examination in this arrangement. A candidate who has handled specimens and performed experiments with his own hands would be able to appreciate and properly understand the subject of bacteriology. Such a knowledge of bacteriology is essential whether he is heading a composite department or not. At present, what I find is that the standard of examinations for M.D. in pathology, where bacteriology is taken as subsidiary, varies from place to place and the variation is sometimes very wide. In some places, many examiners—often they themselves are microbiologists—consider knowledge of bacteriology as an inessential requirement and, therefore, the examinations are often conducted in a lighthearted way. In some other places the scheme of the examination is elaborate but the knowledge expected is very little. In my experience, I have found that in many places no proper training is being given in bacteriology to those who are doing M.D. in pathology. In many places, students do not even spend a month in the department and often neither the candidate nor the microbiology department is interested in the proceedings or in the outcome of the examination in bacteriology. Such a state of affairs is indeed pitiable. It appears to me on going through the syllabi and from talks with various pathologists that the original intention of having the subsidiary subject of bacteriology for M.D. in pathology was (1) that the candidate should answer a paper in general bacteriology and applied bacteriology and (2) that he must be able to report correctly on pathological specimens for diagnosis. With these objects in view papers are set and practicals devised. We give him either a mixture of organism or a pure culture of an organism and a pathological material like a swab or faeces or urine for *culture and reporting*. We give him experiments in serology like a Widal or a Kahn or VDRL. We ask him to do certain animal experimental teachniques like bleeding a guinea-pig, intra-cerebral

inoculation into young mice, injection of infectious material via various routes into animals, etc. With the considerable advances in the field of virology, many people feel that they should know the elements of virology also. This will add to the burden and there are too few places in India where such a training can be given. Moreover, there are too few people who can give such a training.

The case of parasitology is far from satisfactory. With parasitic diseases playing such a havoc in our country and being the causes of many major ailments, the emphasis on parasitology both in the undergraduate and in postgraduate curriculum is woefully inadequate. I must confine myself to the postgraduates and I must add that a student of postgraduate class must know as much of parasitology as a first class undergraduate is expected to know. Whether he should have a separate paper, or whether he should have a separate practical, are questions which are not easy to answer. At many places, parasitology is taught by the bacteriology department; at some places it is taught by the pathology department and at all places it is taught by the preventive medicine department. Thus, there is a division and a duplication of labour in the medical colleges with no streamlined or sensible *via media*. I would personally prefer parasitology to be taught by the preventive medicine department, particularly at present, because preventive and social medicine is being taught in a more elaborate way right from the 3rd year onwards everywhere. Medical parasitology should be an essential component of any preventive medicine department and it should be their job to teach it. Till such a decision is made, the course of study to be covered by the postgraduate in pathology is linked with the question whether he is expected to teach and/or also to do research in parasitology or not. Today the functions of the pathologist in regard to parasitology, at those places where parasitology forms part of the department, are diagnosis in the clinical pathology department, setting up of practicals for undergraduates and giving of lectures. For this, the knowledge possessed by a first class undergraduate would be more than adequate. As to whether there should be a paper or part of a paper in theory, or whether it should form a major division in the practicals and an integral part in the *viva*, all these would depend upon what the pathologist is expected to do. In any case, his knowledge should be equivalent to that of a first class undergraduate.

It might appear from what I have said above that I have not given any clear answers and that I have only posed a number of questions. But the very fact that such a large number of questions have been posed indicates that our first task is to get acquainted with the problems confronting us. And, once the problems are ascertained, the answers follow. I certainly feel that, to expect a postgraduate in pathology to be omniscient in pathology and microbiology, does not conform to the existing practice outside our country, nor is it humanly possible for a person to be omniscient in both the sciences.

REPORT OF THE SUB-COMMITTEE ON PATHOLOGY

PROF. P. N. WAHI

Chairman and Principal, S. N. Medical College, Agra

DR. D. J. REDDY

Rapporteur, Principal, Medical College, Pondicherry

The objects and aims of postgraduate training in pathology were outlined as follows:

1. To produce postgraduates to teach and to carry out research.
2. To produce specialists for laboratory services as a part of the patient-care programme.
3. To impart postgraduate education in pathology to postgraduates in clinical subjects.

Institution Requirements

A postgraduate department of pathology should be adequately equipped and staffed and should have the following sections: well-organised surgical and autopsy services; cytology; experimental pathology; chemical pathology ; clinical pathology; haematology; histochemistry; museum; and audio-visual aids. Each of these sections should be under the guidance of an associate professor with training in the sub-speciality.

In addition, good departments of biophysics and biochemistry should be closely associated with the department of pathology. There should be a good departmental library with a reprint section. An air-conditioned instrument room and a conference room are necessary.

Nomenclature of Postgraduate Degrees

The three degrees to be adopted are (1) Diploma in Clinical Pathology, (2) M.D., and (3) Ph.D.

Duration of Training

The course leading to the D.C.P. should require two years, the M.D. course four years after full registration, and the Ph.D. course six years after full registration, or two years after obtaining the M.D.

Method and Content of Courses

The emphasis of the courses should be on self-education through in-service training, surgical conferences, clinico-pathological conferences, tumour clinics, seminars and group discussions. Day-to-day material in the department should be used for teaching by means of demonstration and discussion. The postgraduate student in pathology should not only acquire competency in tissue diagnosis but should also be introduced to the basic skills and techniques of processing tissue specimens in a clinical laboratory. An introductory course in the basic sciences,

including principles of animal care and breeding, and medical writing should be compulsory for all students. They should also have a six-month training period in the department of bacteriology, where they can learn principles of bacteriology, serology, immunology, and parasitology.

M.D. and Ph.D. candidates should learn research methodology through participation in the research programmes of the department and the preparation of theses. Thesis should be submitted either before or within one year after the examination for the degrees, and they should receive an objective evaluation with a grade. Special recognition should be given to exceptional theses.

Postgraduate Training for Clinical Specialists

The pathology department has an important role in imparting postgraduate training for a clinical speciality. This can best be done by having the candidates appointed full-time to the pathology department for six months. During this time they should participate in all the service and teaching programmes related to their specialities.

ORGANISATIONAL PATTERN OF POSTGRADUATE TEACHING IN MICROBIOLOGY

PROF. N. L. CHITKARA

Department of Pathology & Bacteriology, Medical College, Amritsar

THE pattern of teaching in microbiology, as in any other science, should cater to those aims which are governed by local requirements. The basic needs of every country are similar but they differ because of different priorities. Ours is a fast-developing country and postgraduate education in the medical science is still in its infancy. Thus, we have to evolve a pattern which suits us best.

From the point of view of priority, the aims of postgraduate education in microbiology in our country should be as follows:

1. Diagnostic service.
2. Teaching.
3. Research.

In a majority of the medical colleges in India, pathology and bacteriology are combined at the undergraduate level and in some even at the postgraduate level. In more developed countries, however, microbiology is a separate discipline, and in view of the vastness of the subject, this is highly desirable. Therefore, at least at the postgraduate level, microbiology should be separated from pathology in the Indian universities as well.

POSTGRADUATE COURSES

1. Diploma in Clinical Pathology (D.C.P.) in which clinical bacteriology forms only a small part.
2. Diploma in Bacteriology. This has not been introduced in any university in our country so far.
3. M.D. (Microbiology).
4. Ph.D.

It has to be seen yet how these teaching courses fit in with our requirements.

For diagnostic service, a one-year diploma course in clinical pathology and bacteriology should ordinarily serve the purpose. Such trained personnel are, particularly, needed for non-teaching hospitals. We must remember that hospital care depends largely upon its laboratory service and, as regards bacteriology, at the moment, nothing exists in the non-teaching hospitals. The question arises whether training in such courses, as exist at present in different parts of our country, serves the purpose or not. To my mind, the answer is, no. Then should these

be scrapped? I will again answer in the negative. The reason for this is not far to seek. Our standards of teaching, at the moment, are poor and for this we ourselves are to be blamed. But diplomas have no place in a teaching institution.

M.D. This should be open to medical graduates only. There should be 3 years of intensive training. Emphasis should be on practical training and research methods. It shou'd cover all the branches, viz. bacteriology, virology, mycology, serology, immunology and parasitology with, of course, a greater emphasis on one of these specialities. In addition, the candidates should have some training in medicine and biochemistry too.

Ph.D. It should be a research qualification in any one of the branches mentioned above with a background of the knowledge of other subjects.

After M.D., medical people may be encouraged to do Ph.D., thereby specialising in one particular branch. Non-medical graduates may also be encouraged to work for Ph.D. so as to equip themselves for research in the various specialities of microbiology.

The aforesaid postgraduate training courses should serve the purposes of both teaching and research.

SELECTION OF CANDIDATES

Microbiology is a medical science and is linked with the concepts of biology, chemistry, and physics. It is essential that the students have a good knowledge of these subjects. By the time the medical graduates come out of the universities, they usually forget most of the basic subjects and it may be necessary to impart a re-orientation course in biochemistry at the time of the M.D. training. Only those with an aptitude for the subject should be selected.

NON-MEDICAL MEN AS TEACHERS

They are well suited for the teaching of biochemistry in relation to microbiology. In fact, they can excel the medical men in fundamental research in this subject and they must be encouraged and respected as much as any medical person, if not more, for postgraduate training in microbiology.

ORGANISATION OF DEPARTMENT

The postgraduate department of microbiology should be divided into the following sections, each under the charge of an associate professor with one assistant professor and 1-2 lecturers or research officers:

1. Bacteriology.
2. Virology.
3. Mycology.
4. Parasitology.
5. Immunology.
6. Biochemistry.

The overall charge should be under a professor who should have at least 3 years of experience as an associate professor. The staff may not be available immediately.

AIMS AND CONTENT OF POSTGRADUATE MEDICAL EDUCATION IN MICROBIOLOGY

*B. RAMANARAYANA MURTI

THE science of microbiology forms the foundation for the study, prevention and eradication of communicable diseases. These ailments are still very common in India and contribute, to a large extent, to morbidity and mortality. Therefore, the training of microbiologists is, and will remain, very important for several years. Not much of microbiology is included in the undergraduate curriculum and even less of practical work. Therefore, the postgraduate in microbiology practically starts from scratch.

AIMS OF POSTGRADUATE MEDICAL EDUCATION IN MICROBIOLOGY

The young men and women who take up microbiology as a career will be the future teachers at undergraduate and postgraduate levels, research workers and workers concerned with manufacture and standardisation of sera, vaccines, etc. The aim of postgraduate education in this speciality should, therefore, be such as to fit the student into any one of these appointments.

The type of people to be selected should be medical graduates who have an aptitude for the subject. Non-medical graduates will not generally be suitable for some of these appointments, as knowledge of clinical medicine is essential for an understanding of preventive medicine. The period of training should be at least one, if not five, academic years. The subjects to be covered in the training should include all aspects of microbiology, such as bacteriology, immunology, virology, medical mycology and parasitology.

CONTENT OF POSTGRADUATE MEDICAL EDUCATION IN MICROBIOLOGY

During the first academic year the student should go through a course in microbiology planned on the lines of the diploma in bacteriology of the London or Manchester Universities. It is important to point out that the training should be more in practical work than in the acquisition of theoretical knowledge.

TRAINING IN BACTERIOLOGY

Training in bacteriology should include lectures and practical work dealing with all the common and not so common pathogenic and commensal bacteria affecting the human body. Each organism should be studied in all its aspects, such as morphology, growth requirements, cultural characters, biochemical activities, antigenic structure, toxin production and pathogenicity. Practice in testing the sensitivity of organisms to antibodies and chemotherapeutic agents

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should also be given, as this has assumed considerable importance now. During this period, the student should also learn how to take care of laboratory animals, such as feeding and breeding of different laboratory animals, inoculation by various routes into different animals and animal autopsy. A laboratory for postgraduate teaching in microbiology should have stains of all the required bacteria. These should be properly preserved.

TRAINING IN IMMUNOLOGY

Training in immunology requires performance of precipitation tests, agglutination tests and complement fixation tests: the last should include standardisation of the reagents used such as haemolysin, complement and agglutinable suspensions. Recent refinements, such as Oudin and Ochterlony techniques and agglutination of antigen-coated erythrocytes and collodion particles, should also form part of the training in immunology as these are being exploited to a considerable extent in research and even in diagnostic work.

TRAINING IN VIROLOGY

Virology has assumed even greater significance now as most of the diseases of bacterial etiology are amenable to therapy while diseases of viral origin are not. Also, more and more viruses are being discovered everyday and it is becoming possible to describe the etiology of some of the diseases not previously understood. Virological techniques differ somewhat from bacteriological techniques. An extensive course in virology is necessary and should include inoculation and harvesting of eggs, animals and tissue cultures and refinements of these techniques and special aspects of viral immunology, such as haemagglutination and its inhibition, neutralisation tests in animals and tissue cultures, pock counts and plaque counts. The laboratory should have a well established virology section.

TRAINING IN MYCOLOGY

It is essential to give sound training in mycology. The subject is not included in the curriculum of the undergraduates and so it is essential to start with bare fundamentals as mycological techniques and terminology are completely new to the student. The course should enable the student to learn about the morphology and physiology of fungi in general and also something which is of medical importance. The practical work should be designed to enable the student to handle fungi with confidence and to familiarise him with free living fungi and also with these occurring as contaminants in cultures. A separate section on mycology should exist in the laboratory.

TRAINING IN ENTOMOLOGY

Insects play a great part in the transmission of communicable diseases. A short course in entomology and practical work wherein the adults, eggs and larvae of insects are examined and identified should be included in the course of study.

Preparation and standardisation of vaccines and sera is not undertaken in teaching departments. The postgraduate students should be sent to some place, such as the Haffkine Institute, the Central Research Institute or the King Institute of Preventive Medicine, to enable them to learn the technique of preparation and standardisation of vaccines and sera.

Research workers in microbiology would need a sound knowledge of advanced chemistry and biology. It would be advisable to have some graduates admitted to the course so that they have the necessary background of these sciences to be able to do research work involving a knowledge of chemistry or biology.

During the second year of study, the postgraduate should use this background knowledge for writing a thesis for his examination and also learn the application of this knowledge to medicine.

This should equip a postgraduate student fully to undertake any kind of work in any type of institution dealing with microbiological work.

PLACE OF VIROLOGY IN POSTGRADUATE TEACHING

Dr. S. L. Kalra

It should not have been necessary to talk on the subject to such a gathering. However, the relative importance of teaching any subject in medicine depends on the morbidity and mortality produced by the diseases in that group.

So far as India is concerned, the incidence of viral, parasitic, and mycotic infections is high. I am not mentioning bacterial diseases because a large member of diseases in this group can be controlled by the wide range of antibiotics and some can be prevented by vaccines.

It has been said that the incidence of mycotic infection in a country is related to the number of trained mycologists in that country. I think this applies equally to viruses and parasites. In recent years viruses have been responsible not only for sporadic cases with seasonal rises, but also for some epidemics. The outstanding instances are: smallpox, infective hepatitis, haemorrhagic dengue, influenza, and K.F.D. I suppose it is on account of epidemics of infective hepatitis and the introduction in the country of newer viral infections, such as haemorrhagic dengue, chikungunya, K.F.D., African horse sickness, that our attention is focussed on the teaching of virology.

It is time, therefore, that the teaching of virology is introduced at the undergraduate as well as at the postgraduate levels in medicine and in microbiology.

The task of the microbiologist will be (1) to give diagnostic aid, (2) to find the viruses prevalent in the country, (3) to study the epidemiology of prevailing viruses, and (4) to be capable of producing vaccines, when required.

The physician must know about viral infections. He should know what diagnostic service the laboratories can provide, what material he should send for diagnosis, at what stage of the disease he should collect it and what precautions are necessary in forwarding the material to the laboratory.

We have to train virologists who can investigate an outbreak of a viral infection in the field and in the laboratory and we require personnel who can prepare viral vaccines. Importation of prepared vaccine is too costly and regular supply cannot always be depended on.

If rabies vaccine had to be imported, it would not have been possible to give it to any one who required it. The eradication programme of smallpox is also handicapped because the bulk of the vaccine is imported. It was due to the lack of trained personnel that during the last epidemic of influenza the vaccine was not prepared in time. The vaccines to be used on a large scale have to be cheap and readily available which is only possible if they are prepared in the country.

The Virus Research Centre at Poona started by Rockefeller Foundation and I.C.M.R. has contributed, in a large measure, to our knowledge of viral infections in India and also helped in

training personnel. But it is time that training facilities are made available in other places also, and to a larger number of persons of different categories.

But for the Virus Research Centre we would not have known about K.F.D. which, we thought, belonged to an enteric group of fevers. But for this knowledge we would have been still vaccinating people with TB vaccine and chlorinating the water supply and feeling happy that we have controlled the disease. We would not have known that the disease, being seasonal, vanished automatically. In fact, this is what happened in the first two years of the history of this disease.

We have the responsibility for the health of the nation and we cannot discharge it if we ignore the large group of diseases caused by viruses.

MYCOLOGY AND ITS PLACE IN MEDICAL EDUCATION

DR. L. N. MOHAPATRA

ALTHOUGH a fungus was recognised as the aetiologic agent of favus in man as early as 1839 by Scholein, relatively little is known about fungus diseases compared to the accumulated knowledge regarding the bacterial and virus infections. Madurafoot, a term originating from the first human mycotic disease reported from India, has found a place in medical terminology but very little is known about the mycotic infections in this country and much less about their aetiologic agents.

In the advanced countries of the world, medical mycology is a well recognised laboratory speciality. The fungus diseases known at present, their causative agents and various aspects like their geographic distribution, incidence and epidemiology came to be known in the middle of the century.

Yet a lot remains to be known and the lack of information has resulted from methods of study which stressed the clinical aspects of the diseases rather than the infectious agents and the pathogenesis of the disease they cause. Besides these, the rise in the incidence of fungus infections due to extensive use of broad spectrum antibiotics and corticosteroids and various palliative therapies used to prolong life in certain malignant diseases, demand more attention for their proper understanding. To this may be added the problems of "mycotoxicosis."

Another reason for the lack of information on fungus infections is their mild nature and protean manifestations. A high index of suspicion regarding these infections amongst the medical profession is the first prerequisite of furthering our knowledge in this field. But this requires to be substantiated by adequate laboratory help. Diagnostic mycology is still a developing science and requires research ability and orientation if the opportunities for scientific studies of the mycoses are to be fully exploited. Research studies related to cases, focal outbreaks and epidemiologic patterns of mycoses have elucidated many of the features which distinguish the mycoses from other infectious diseases.

In India, there have been a few studies of the dermatomycoses and their aetiologic agents from different parts of the country. These reports, with a few exceptions, are in agreement about the prevalence of the types of dermatophytes responsible for various clinical conditions. But these reports only indicate the state of affairs in the urban population. Knowing fully well that there are dermatophytes causing disease in man which are zoophilic and geophilic in nature, this picture is likely to be different when the rural population is analysed for their incidence. The reports regarding the incidence of systemic mycotic infection are only occasional. Even the skin test surveys of a systemic mycosis (histoplasmosis), known to be worldwide in distribution, are far from complete but nonetheless indicate that the fungus is present in certain areas in this country. Thus, the knowledge of different mycotic infections

prevalent in this country is very insufficient for broad generalisation. This is because the laboratory facilities for isolation and identification of the fungi causing disease in man are very inadequate in most of the medical centres, not to speak of the district and sub-divisional hospitals. The lack of a suitable training programme in the medical curriculum of the under-graduates and especially in the postgraduate course is responsible for this state of affairs.

Fortunately, most of the fungi-producing diseases in man and animals are not very exacting and can be grown on simple nutrient media. Thus, the mycology service is neither expensive nor does it require an elaborate setup. The only setback, therefore, is the lack of knowledge of, and familiarity with, these agents during specialisation in the different branches of medicine, especially in microbiology. A visible and rewarding change can be brought about within a very short period by exposing our postgraduate students to a short but intensive course on the fungal infections and the fungi that cause them. While this can be arranged with much less effort, attempts should also be made to establish a chain of reference and training laboratories attached to various teaching institutes throughout the country. These laboratories can also take up the study of broader aspects like natural habitat of the aetiologic agents and their epidemiology in that part of the country.

It will amount to defeating the purpose to get away with the idea that a mere knowledge of the known pathogenic fungi is all that is required for this purpose. This may be adequate for persons required to give laboratory service to hospital and O.P.D. patients but people in these reference laboratories, studying fundamental aspects concerning the aetiologic agents, should also have more extensive training in general mycology. There are many features which distinguish the mycoses from other infectious diseases requiring team-work and close collaboration among the clinicians and the laboratory men.

The plans for the future development and the proper utilization of facilities should keep pace with the present state of affairs in this country. Therefore, to set the ball rolling, the mycologist in a diagnostic laboratory should have an intensive short course enabling him to do a creditable job. The people interested in the subject can be given this training in a few selected centres where the facilities exist at present. Training over, we can have small service laboratories all over the country, mostly in medical centres. This, in its turn, will facilitate the establishment of research laboratories and feed the regional reference centres with valuable data and materials. The regional research and reference laboratories should not only be giving short intensive courses but also should take up major problems concerning the prevailing etiologic agents in that region and their epidemiological aspects. In view of the non-availability of properly trained staff to do this job on a wide scale, the problem can be tackled by utilising the services of the few available people through some agency which will give financial help to this travelling group moving from one medical centre to another organising short intensive courses. When a fairly large number of medical mycology centres are covered and start functioning by setting up the routine diagnostic service, attempts should be made to consolidate the regional research laboratories with the help of the same team. To begin with, these short lecture-cum-demonstration courses should be open to all clinicians, medical officers manning diagnostic laboratories and senior technicians. Subsequently, people interested in organising the service laboratories can get further training in the regional laboratories from time to time, either by attending

organised courses or by spending some time in these laboratories according to their convenience. To start with. as a test case, courses can be arranged during the summer vacation and teachers from medical centres may be encouraged to attend these courses.

In this connection, it may not be out of place to mention the plans proposed by the I.C.M.R. to give an incentive to this programme. While such a programme is launched, it should also be kept in mind that the different regional centres in the country need not follow a rigid programme and a similar pattern. Some of the centres may take up problems peculiar to that region and others may devote more time and energy to certain groups of fungi like dermatophytes, the agents of chromoblastomycosis, fungi causing mycetoma or the fungus causing one or the other systemic mycosis. Thus, a much wider field can be covered and more intensive work can be done on different aspects of these conditions.

Lack of properly trained personnel and non-availability of adequate dependable diagnostic facilities need to be remedied to fill up the gap in our present knowledge regarding the incidence prevalence and epidemiology of different mycoses in our country. The Indian Council of Medical Research has put emphasis on the need to promote research in medical mycology while drawing up its programme. It is encouraging to learn that a few centres are busy investigating mycotic infections. It is time we all realise the truth in the old saying: "a wise man will hear and will increase learning and a man of understanding shall attain unto wise counsels."

PLACE OF PARASITOLOGY IN POSTGRADUATE MEDICAL EDUCATION IN MICROBIOLOGY

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WE must confess that teaching of parasitology as a branch of microbiology at the post-graduate level (M.D. degree) is almost non-existent in most of the medical institutions in India. The reasons for this are not far to seek. First, it is only in the recent past that micro-biology has been separated from pathology in some institutions in India. Even so, in many institutions, microbiology is still not a separate subject of study. We must treat pathology and microbiology as separate subjects at the postgraduate level if we can venture to talk of para-sitology. In my opinion, microbiology has played a second fiddle to pathology. Microbiology is a vastly expanding subject with its varied branches. It is impossible for anyone to practise and teach more than one branch with any degree of confidence. Of all the branches of micro-biology, parasitology has had the greatest neglect. After the last war, it was conjectured that with advances in technology parasites would all be eliminated by breaking their life cycles and progress would be possible by the use of chemotherapy, insecticides and molluscicidal agents at our command. All that was needed was money and organisation. So parasitology fell out of fashion. These conjectures, though based on sound reasoning, have provided us with instances of resistance in parasites, ecological upsets and various other problems. Moreover, eradication of man's infection demands a change of environment and this seems impossible and to an extent even unacceptable. In a new nation like India a part of the culture of the Indians is their ecology. If you change this entirely, you change them. This does not imply living in filth and squalor but living in relative harmony with the parasites.

Parasitology is taught by many who have little interest in the subject. Yet, according to Stoll, 2,257,100,000 persons on the globe harbour helminthic infections and Brown makes an educated guess that an equal number harbour parasitic protozoa. There is a greater awareness of some parasitic syndromes like larva migrans, Toxoplasma, and Angio-strongylus. Many zoonoses like filariae, babesia and haemogregarines have come to light. The drug resistance of malarial parasites and trypanosomes poses another threat that cannot be taken lightly. All this demands a more vigorous pursuit of the subject.

Research in parasitology has shifted from the description, systematics and epidemiology to a greater emphasis on studies concerned with immunology, physiology, and biochemistry. Fundamental studies in biochemistry would ultimately give us the answer to drug resistance. Immunology has made rapid strides and has provided us with information regarding prevalence and control of various parasitic diseases. In toxoplasmosis, amoebiasis and schistosomiasis—to name a few—techniques of immunology have brought about definite advances in the under-standing and diagnosis of the disease. Immunofluorescence and electron microscopy have

contributed in their own way. Modern mothods of culture for such organisms as amoebae, trypanosomes and plasmodia are some of tbe advances made in the recent past. The axenic cultivation of amoebae and other protozoa is a new tool that is bound to give us further insight into tbese organisms. Attempts at cultivation of filarial worms are in progress and some success has been achieved.

Teaching and research in parasitology can be improved only if there are people in medical institutions entirely devoted to this branch of microbiology. This necessitates its recognition as a separate discipline. This is all the more important in a country like India where parasitic diseases are indeed common.

It would be, however, necessary only to teach it as a branch of microbiology at the M.D. level, in view of our present state of development, but certainly more vigorously. Since it is to be taught only as a branch of microbiology, too much emphasis on morphology and systematics would be out of place. These fall in the domain of a pure parasitologist. The teaching of parasitology has to make use of the same basic concepts as utilized for teaching microbiology in general but emphasis has to be placed on the study of parasites in their mature and immature forms and their ova. Methods of concentration for blood and various excreta, such as stool, urine and sputum, should be dealt with in detail. Methods of culture for leishmania, trypanosomes, amoebae and other intestinal protozoa should be covered. Techniques for preservation of protozoa and helminths should be practised. A varied collection of slides showing various protozoa, helminths and their ova, vectors and intermediate hosts would broaden the outlook of the student. It would be an added advantage to supplement this by tissue sections demonstrating pathologic lesions in man.

Parasitology would be incomplete without the student having some background in medical entomology. This should include important arthropods like mosquitoes phlebotumus, simulium, culicoides, chrysops, musca domestica and related species as well as glossina stomoxys, myiasis producing flies, fleas, lice, bugs, ticks and mites. A section on medical entomology is absolutely essential for pursuing such an aim (Appendix I).

A list of subjects to be covered in parasitology and of recommended journals and books to be read is given in Appendixes I and II respectively.

nematomorpha, gordiacea); Flatworms (plathelmintes, digenetic trematodes or flukes (Schistosomes, amphistomate and distomate flukes); cestodes (tapeworms), pseodophyllidean and cyclophyllidean; thorny-headed worms (acanthocephala); leeches.

Techniques of examination of specimens; culture and immunologic techniques.

APPENDIX II

Journals of interest for parasitology.

1. Journal of Helminthology.
2. Journal of Parasitology.
3. Journal of Protozoology.
4. American Journal of Tropical Medicine and Hygiene.
5. Transactions of the Royal Society of Tropical Medicine and Hygiene
6. Annals of Tropical Medicine and Parasitology.
7. Experimental Parasitology.
8. Helminthology Abstracts.
9. Journal of Infectious Diseases.
10. Indian Journal of Medical Research.
11. Indian Journal of Microbiology.
12. Indian Journal of Pathology and Bacteriology.
13. Journal of the Indian Medical Association.

Review

1. Craig and Faust's Clinical Parasitology (1964).
2. Human Parasites and Parasitic Diseases—K. D. Chatterjea (1952).

THE ROLE OF "SEROLOGY" IN POSTGRADUATE MEDICAL EDUCATION

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SEROLOGY is a practical science of the study of the altered reactivity in the serum following spontaneous or experimentally induced infection, or following the injection of harmless materials in human beings and animals.

Serology is based on the principles of Immunology which is the science concerned with the mechanism by which immunity or resistance to disease or harmful foreign substance is increased, and with the methods of diagnosing or preventing disease or influencing its course, using sera and vaccines.

Immunology, broadly speaking, may also include the study of hypersensitivity, the reverse of increased resistance, because hypersensitivity is conditioned in most cases, if not all, by a mechanism similar to immunity involving the presence of antibodies resulting from antigenic infectious agents, or exposure to foreign substances.

The term "allergy," which is often used as a synonym of hypersensitivity, was defined originally by Von Pirquet as an "altered reactivity state." Therefore, it may include hypersensitivity and "hypersensitivity of immunity," all of which can be studied with serologic techniques.

Considered as a collection of experimental and diagnostic technical procedures by which foreign substances (antigens) and specific reacting substances (antibodies) in serum are detected and measured qualitatively and quantitatively, serology would cover in its application a wide field of disciplines: biology, microbiology, immunology and allergy.

The quantitative measurement of the immunologically reacting substances in sera is covered by the term "immuno-chemistry." The quantitative chemical methods permit the measurement of the amount of the reacting substance in sera on a weight basis with a precision conforming to the requirements of analytical chemistry. This has contributed materially to the making of immuno-chemistry into an exact science. Therefore, immunology and its sub-discipline of serology have sound scientific foundations and their ancestors may include bacteriology, physiology, chemistry and physics.

The physician and the layman may think of immunology as the study of the specific resistance against infectious diseases, and serology as the practical procedure for diagnosing the same. To the biologist, however, immunology is a physiologic phenomenon, an expression of the ecologic principles and the laws of natural selection and evolution. The chemist is challenged by the physico-chemical peculiarities of the immunologic process, and the serologic antigen antibody reactions, and may go as far as to think of them completely apart, from men and animals,

to the confusion of the physician and the biologist. Historically, microbiology, immunology and serology have grown side by side, but immunology and serology, considered as subjects in their own rights, cover a far wider field than their microbiological aspects.

Serologic method

Most of the newer serologic techniques are evolutions and refinements of the classical serologic reactions well known to all students of medicine, namely, precipitation, agglutination, neutralization of toxins and complement fixation. The antibody, which in the past has been regarded as a somewhat enigmatic substance demonstrable by the above serologic effects, is now being studied by different groups of scientists using newly discovered methods of physical chemistry and biochemistry. The ultra-centrifuge, chromatography, electro-phoresis, immuno-electrophoresis, immuno-diffusion, immuno-fluorescence, and the isotopes, have given us advanced modern scientific techniques for deeper insight into the constitutions of the antigens and the antibodies besides giving us information on the role of gammaglobulin and the cells producing them, thus providing scientific enlightenment in clinical and preventive medicine. The discipline of serology has, therefore, recently acquired several new techniques in its fold, which could be applied to a wider variety of biologic and other problems quite apart from the study of diseases, their diagnosis and the defence against them.

Application and scope of serology

Serologic methods have been and are being used·

(1) In the diagnosis and epidemiology of infections diseases, the investigation of other diseases, such as mylematoses and hypogamaglobinaemia, by the immuno-electrophoresis of globulin, and also in the diagnosis of collagen disorders, with L.E. and Rose Waaler and immuno-fluorescence tests.

(2) In the investigation of allergic states including auto-allergic or auto-immune states.

(3) In the promotion of immunity or resistance to diseases.

(4) In the grouping of blood and its application to blood transfusion, in the diagnosis and treatment of haemolytic disease of the "new-born," and in the investigation of haemolytic anaemias, disorders of platelets, and leucocytes.

(5) In the investigation of transplantation immunity and homograft and heterograft reactions in the field of surgery.

(6) In the immunology of reproduction, sterility and its potential, practical application to contraception, family planning and population control.

(7) In forensic science, such as the problems of identity and origin of materials of biologic origin like individual tissue fragments, and fluids, taking advantage of the species specificity of proteins.

(8) In the identification and classification of micro-organisms in microbiology.

(9) In the biologic classification of animals and plants in view of the unique property of the specificity of antibody in sera. Zoology, botany and anthropology departments are beginning to realise that the serologic methods are precise and simple enough to be of use in their problems of taxonomy and genetic analyses.

(10) In *genetics*, genital differences may be determined in substances by the latest serologic method of Gel diffusion.

(11) In the detection and measurements of biological entities, such as *ramenzyme* and *hormones*.

(12) *In chemistry*, the chemists have recognised the value of serologic techniques of antigen and antibody reactions and their specificity as models to study the interaction of large molecules and to provide information regarding the specific arrangement of atoms in molecular structures.

Qualifications and requirements of a serologist to teach and practise serology

It has been considered that microbiology can be learnt and also taught as a pure science without the clinical knowledge of medicine. Therefore, immunology and serology, being subdisciplines of microbiology, may also be learnt and taught as pure sciences. As it is based on biology, chemistry and physics, serology may be learnt and taught by a non-medical scientist. In fact, a non-medical scientist may do comparatively better in learning and conducting fundamental researches and teaching serology. And a medical student should do better if he has a training in basic sciences, particularly chemistry.

The role and scope of work of non-medical scientists in medicine has been a matter of controversy. There is often an unhealthy atmosphere of conflict between the medical and non-medical scientists working together in medical institutions. The lack of basic knowledge, or even half knowledge, of medicine among non-medical scientists working in non-clinical departments of medicine, has been considered dangerous, in that they may make a diagnosis of disease on their laboratory findings alone. On the other hand, the lack of adequate knowledge in the basic sciences of chemistry and physics makes it difficult for the medical scientist to become perfect in the non-clinical disciplines, particularly serology and biochemistry. Therefore, both these categories of scientists have important roles to play in non-clinical medical specialities, particularly in serology, working in close collaboration and co-operation. The non-medical scientists should be specially encouraged to come into the medical fields, by providing them good prospects of income and honourable status as associates, if not as equals to medical scientists. The medical postgraduates who want to take up the discipline of serology must be selected with due regard to their basic qualifications in chemistry and biologic sciences. If they can be attracted into this speciality, they of course will be the ideal heads of the department of bacteriology, serology and immunology. In fact it is felt that these disciplines may not be completely isolated from clinical medicine even if they are considered pure sciences.

and for a few other infectious diseases. Immunology is included as a theoretical subject in the curriculum. Even in the diploma course in clinical pathology, there is scope for increase in the practical lessons in the field of serology, so that the diplomates may practice serology in district and private laboratories, in a wider field of medicine, more usefully and effectively than at present. As for the postgraduate degrees, facilities should be offered for serology, to be included in the M.D. or M.Sc. degree courses in bacteriology or microbiology as a special subject, so that the more advanced theoretical and practical aspects of serology may be acquired by the postgraduates concerned and they may become suitable teachers in the speciality. The Ph.D. degree may be offered in serology, after M.Sc. or M.D. in general bacteriology, so that the postgraduate concerned is qualified to conduct, organise and guide fundamental research in this field.

For non-medical graduates, M.Sc. and Ph.D. postgraduate degree courses should be offered at the medical institutions in the speciality of serology, so that as associates they may have the benefit of the wisdom and knowledge of these non-medical scientists in the medical field.

It may be thought that serology is a rather limited field of discipline because it is only an applied practical aspect of immunology. If so, the name of this speciality may be changed into *Immunology* including *Serology* or even into *Immuno-Serology* so that this speciality may have scope for wider activities to be covered in the medical sciences.

It is felt that the Indian Association for the Advancement of Medical Education is the most appropriate body to take up this matter in its various aspects, and it is gratifying that in this meeting the importance of this developing subject of serology has at last received the attention of the scientists in charge of non-clinical medical sciences. I am glad to be offered an opportunity to share my views and experience in this speciality. Let me hope the scientists concerned will give guidance and advice to medical institutes in this country to provide facilities for the development of the subject.

HOW MUCH PATHOLOGY FOR A POSTGRADUATE IN MICROBIOLOGY

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THE object of the study of microbiology in the medical faculty is twofold, namely, (1) the study of biological properties of bacteria, rickettsia. viruses fungi and protozoa, their morphology, nutrition, growth, multiplication and mode of propagation; and (2) the study of the biology of infections and of the interaction of two biological systems, the host and the parasite.

Historically, microbiology grew up as bacteriology within the departments of pathology. However, over the decades, there has been a phenomenal growth of this science and the infant prodigy has now grown to its full stature acquiring the status of a fundamental academic discipline within the broad field of biology.

The study of biology of the microscopic and ultra-microscopic organisms has, on the one hand, made it possible to control and eradicate some of the worst scourges of mankind and, on the other, it has also thrown new light on some of the fundamental life processes, particularly in the field of cell metabolism and genetics. However, in its practical application, medical microbiology is more intimately concerned with the elucidation of host response and host reaction to the parasite. Here, a distinction may be made between the epidemiology of infections and that of infectious diseases. The first is concerned with the ecology of micro-organisms, their mode of transmission from host to host and their survival in the external environment. On the other hand, infectious diseases present a complex problem where the parasite is in varying relationship with the host's internal environment. It is well known that disease is really the result of interaction between the host and parasite and every infection does not necessarily lead to disease. The problem of virulence and pathogenicity could only be understood in relation to a given species or population of hosts. In these, apart from the intrinsic properties of the parasite the host factors are equally important, such as innate resistance, evolutionary adaptation through genetic changes, immunological response and disturbances in the internal and external environments. Also, the phenomenon of latent infections—the carrier state—and activation of dormant infections could only be understood by a study and analysis of host-parasite relationships. The general trend in medical microbiology has so far been to regard the parasite as an aggressor and the host as a resister. This anthropomorphic approach has no doubt yielded a rich harvest by way of the discovery of immunological and other methods of the prevention of disease as well as treatment by chemotherapeutic and antibiotic agents. It is only in recent years that an attempt has been made to study the host factors more intimately and this has revealed that infection and disease are not synonymous. Therefore, for a student of medical microbiology, it is very important to have an insight into the nature of host-parasite

relationships, the complexity and variety of host-tissue response including specific and non-specific factors in resistance. *Hence, the need for the study of general pathology as an essential and integral part of microbiology becomes obvious.* Furthermore, the discoveries in recent years of such phenomena as immunological tolerance, auto-immunity, etc. intimately link up general pathology with microbiology. The discovery of tumour viruses has also established links between virology and oncology. Haematology, too, has established close links with immunology in the study of auto-immuno-haematologic disorders. With so much in common between pathology and microbiology, there could hardly be any frontiers between these two basic medical sciences; knowledge of the one is a *sine qua non* for the advancement of the other.

INTEGRATION IN TEACHING OF PATHOLOGY AND MICROBIOLOGY

The separation of microbiology from the departments of pathology has, it is true, promoted the rapid development of this discipline but it is also true that it has created a dichotomy. Therefore, in the light of what has been said above regarding the close relationship between the two sciences, it is necessary to develop an integrated approach to the teaching of microbiology and pathology. A teacher of microbiology could play his role effectively only when he is himself fully conversant with the current trends in pathology. The converse holds good in the case of pathologists.

INTEGRATED LABORATORY SERVICE

As is well known, the functions of a medical microbiologist are threefold, namely, (1) research, (2) teaching, and (3) service. If an integrated approach is necessary for research and teaching in microbiology and pathology, it is even more important in the field of diagnostic laboratory service. An intimate understanding of disease processes is a prerequisite for devising suitable laboratory tests and interpreting their results. This can only be done against a background knowledge of pathological processes at various stages of infections.

In Europe, as in the U.S.A., the tendency at present is to have two categories of pathologists for service functions: (1) anatomic pathologists or morbid anatomists, and 2) clinical pathologists. In India, most clinical pathology laboratories have to provide services in all the branches, namely histopathology, clinical bacteriology and serology, haematology and clinical biochemistry. Although, in some of the Southern States, there has been a separation of these responsibilities, the need for integration is being increasingly felt in the administration of hospital clinical laboratories even in the South. Therefore, an M.D. in pathology or microbiology must have an adequate knowledge of the other branches even from the service point of view. It is, of course, imperative for teaching and research.

PATHOLOGY FOR POSTGRADUATES IN MICROBIOLOGY

As a practical approach, an advanced student of microbiology may include the following within the broad field of his studies:

1. General pathology.
2. Systemic pathology with special emphasis on pathology of infectious and parasitic diseases.
3. Experimental pathology of infectious and parasitic diseases.
4. Aetiology, epidemiology and general pathology of tumours.
5. Principles of haematology with special reference to immuno-haematology.
6. Clinical biochemistry (chemical pathology) with special reference to infectious diseases.
7. Practical work in pathology should include the following:
   (1) Autopsies, the techniques of processing of tissue, microtomy and staining of tissue sections.
   (2) Elements of histo- and cyto-chemistry.
   (3) Clinical haematology.
   (4) Clinical biochemistry.

SCHEME OF EXAMINATION IN PATHOLOGY FOR M.D. IN MICROBIOLOGY

1. One paper on general and systemic pathology including haematology.
2. One paper on experimental pathology with special emphasis on infectious diseases.

The practical examination should include:

(1) Performance of autopsy.
(2) Reporting on histopathology slides of infectious diseases.
(3) Haematology—Immunological aspects.
(4) Clinical biochemistry of common infectious diseases.

REPORT OF THE SUB-COMMITTEE ON MICROBIOLOGY, PARASITOLOGY, SEROLOGY

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THE department of microbiology should be a separate department in order to train people for laboratory service, teaching and research. The department should have sections of bacteriology, immunology and serology, virology, mycology, parasitology and entomology and immuno-chemistry. If pathology is taught, it should be restricted to the study of infectious diseases and the tissue response in them.

Medical graduates should be eligible for admission to this course. Some graduates in chemistry and biological sciences may also be admitted into the medical colleges because their knowledge of basic sciences will be useful for specialising in microbiology.

The types of qualifications should be Diploma in Medical Microbiology, M.D., M.Sc. and Ph D. The duration of the course for M.D., M.Sc., and Ph.D. should be three years. The diploma course in microbiology and all medical laboratory sciences should be intensive and practical and for one year. The number of students for the diploma course should be more than in other degree courses. They should be able to supervise small non-teaching laboratories. These diploma holders should be able to register for M.D or Ph.D. and take up a teaching or research appointment.

The second and third years of the degree course should be spent in preparing a thesis and examination. As training in certain branches of microbiology cannot be given in all postgraduate centres, candidates should be sent for short periods to those places where such training is available.

There should be written, practical and oral examinations. While assessing, equal emphasis should be placed on principles as well as on techniques. In the assessment of the Ph.D. candidate, his supervisor should assess and then decide when to allow him to work on his thesis.

All the sections under microbiology should be headed by officers of the rank of professors or associate professors, one of them, preferably the senior one, acting as the co-ordinator of the work. In addition, there should be one assistant professor and two or three lecturers in each section. Additional provision should be made for posts of professors. Two or three supernumerary posts should also be provided. The department should have an adequate number of technical assistants and should be properly equipped.

REPORT ON POSTGRADUATE EDUCATION IN BASIC MEDICAL SCIENCES

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WHILE submitting a consolidated report on the work of the six sub-committees, which were constituted to discuss postgraduate medical education in basic medical sciences, first I should like to record that the sessions were well attended and that the discussions were free and frank because of the very enthusiastic and active participation of all the delegates.

It was realised that medical education cannot achieve much in isolation and individual disciplines by themselves can contribute but little to the progress of medical education and medical research. Inter-disciplinary understanding and faculty co-operation is essential for the promotion of higher learning. Artificial barriers or compartmentalisation due to specialisation or super-specialisation must give place to better intra-departmental, inter-departmental and inter-institutional participation in the existing fields of postgraduate medical education. Other disciplines have much to offer to the medical sciences. Hence, we should not hesitate to collaborate with the departments of basic sciences such as biology, genetics, biostatistics, biophysics, biometrics and biomedical engineering. These may not exist as separate departments in our postgraduate institutions, but eventually such disciplines will have to be developed.

OBJECTIVES

The aims and objectives of higher learning are the advancement of knowledge and through it the creation of future leadership. The sub-committees laid down the objectives of postgraduate medical education in very simple terms.

These are: the training of (1) teachers for the departments of medical colleges, (2) of research workers for our laboratories, and (3) of specialists to serve in our medical institutions and participate in the care of the sick. It was considered a utopian ideal to train all candidates thoroughly in all the three areas, but all should receive some emphasis in the training of each *postgraduate student in the basic medical sciences.*

INSTITUTION REQUIREMENTS

Postgraduate teachers are not available in sufficient numbers, especially in the basic medical sciences. Non-medical scientists should, therefore, be increasingly employed in disciplines such as anatomy, biophysics, biochemistry, pharmacology, and microbiology. They should be eligible for promotion up to the rank of the head of the basic medical science department.

The stature of non-clinical teachers and full-time clinical teachers should also be raised. The implementation of the recommendations of Mudaliar Committee may go a long way towards

creating better conditions for the teachers in medical colleges. A teacher-training programme was also considered essential.

The number of teachers required in each department is related to the responsibilities assigned or undertaken. No department should function as a postgraduate department without at least two properly qualified persons, and each division should have at least a professor or an associate professor, one assistant professor and one or two lecturers. No postgraduate teacher should have the responsibility to train more than three or four graduate students.

POSTGRADUATE STUDENT

The majority of applicants for postgraduate study are below the average; they do not have sufficient aptitude, and often the motivation towards graduation is at variance with the objectives of higher learning. The students are financially poor, they lack proper accommodation and they live a sub-standard existence. Proper motivation of the good students, during the undergraduate career, towards medical research and higher learning, revision of our methods of selection, better stipends and proper accommodation may contribute towards training good leadership for the future.

PHYSICAL FACILITIES

Each sub-committee has stressed the need for developing divisions of each department, thus promoting the development of different facets of the discipline. Thus the needs of the future expansion of sub-specialities should be taken into consideration while planning offices, laboratories, lecture halls or seminar rooms, museums, libraries, etc. A library is essential to a department providing postgraduate work and research. Common facilities in institutions should be provided—a library, animal house (breeding), instrument workshop, audio-visual department, and medical illustration.

It is worth while considering the establishment of service laboratories in postgraduate institutions. Instead of departments duplicating laboratories and costly equipment, a well designed service laboratory having costly equipment, housed in air-conditioned rooms and staffed with well trained technicians, may provide the maximum service with efficiency. In this connection, the training of medical technicians for the development of medical technology may be considered. Technicians with requisite skill for service in the laboratories in different disciplines are essential for processing routine material in bulk. They should be well trained, better paid, and their progress in life should be guaranteed.

EQUIPMENT

Today medical research needs complicated and costly equipment not manufactured in our country. Procurement of such equipment and supply of spare parts have occupied much of our time and drained our energy and enthusiasm. Procedures for procurement must, therefore, be simplified and foreign exchange should be made easily available for the purchase of spare parts and essential chemicals. The maintenance of such equipment needs the organisation of a

good workshop in every institution. Such workshops may eventually be in a position to fabricate research equipment themselves.

DURATION OF TRAINING

Education is a continuing process, but the active training period must be limited to a specific period of time. A majority of the basic science committee advocated a minimum period of three years after full registration to obtain a postgraduate degree. The sub-committee for pathology thought that four years of training were essential. For a diploma course, one year was considered the optimum period of training.

MODE OF TRAINING

Training should be of the "in-service" type. The candidates should be trained in the department. They should have adequate contact with day-to-day activities in the areas of teaching, service, and research responsibilities.

Since the modern graduate in medicine has not had the requisite knowledge in basic sciences and in the principles of modern laboratory techniques, it is considered desirable to provide an orientation course in statistics, biometrics, simple workshop procedures, principles of animal care and handling, introduction of experimental methods, such as designing, collecting data and analysis, medical writing and illustration. Use of the library, development of skill in communication and learning of one or two foreign languages are other areas in which the postgraduate candidates should be interested during the period of orientation. This phase should be followed by an exposure to a general and liberal training in the discipline concerned. Sub-specialisation should come only after obtaining the postgraduate degree.

Research projects should be approved by the faculty before they are undertaken. The results of original work should be submitted either before or within one year after the final examination.

The training should not be didactic. The candidate should actively associate himself with the activities of the department. His development should be guided by the personal supervision of the teacher. Teaching exercises, seminars, journal clubs, joint exercises with other disciplines, such as clinico-pathological conferences, etc., should form important constituents of the training.

Training in interrelated disciplines is important, but its duration and nature are left to the decision of the related departments.

ASSESSMENT

Periodical assessment and proper guidance are essential for the success of the training programme for the postgraduates.

Candidates should also be assessed on their thesis, which should be evaluated by external examiners. An exceptional thesis should merit some special consideration, as decided by each individual institution.

A written examination to test the candidates' knowledge is essential. The multiple choice system or the objective method of assessment should be given a fair trial in our postgraduate examinations.

Practical and oral examinations should also be included in the final assessment of all candidates.

National examinations are suggested as a means of standardising the requirements of a medical degree.

AWARD OF POSTGRADUATE QUALIFICATION

The nomenclature of qualifications was considered by all committees. There was unanimity in recommending the following:

M.Sc. for non-medical graduates.
M.D. for medical graduates.
Ph.D. or D.Sc. for research qualification.

A brilliant student motivated towards research should be able to work directly for the Ph.D. degree after he has obtained the M.B.B.S. degree, and a candidate who has obtained an M.Sc. or M.D. should be able to acquire the Ph.D. after a minimum period of research activity of two years.

The need for diploma courses was emphasised by the sub-committees in pathology and pharmacology. This provides for training service personnel needed in hospital laboratories and the pharmaceutical industry.

The incidental acquisition of a diploma by a candidate working for a postgraduate degree was considered, but it was not recommended.

CONTINUATION OF EDUCATION

Provision should be made for the continuation of education after obtaining the postgraduate qualification through active participation in inter-disciplinary projects and discussions and regular meetings with other members of the speciality.

IV

POSTGRADUATE MEDICAL EDUCATION IN CLINICAL SCIENCES

REMARKS ON VARIOUS ITEMS ON THE AGENDA OF GROUP DISCUSSIONS ON GENERAL MEDICINE

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QUITE a lot of thinking and re-thinking is being done about postgraduate medical education in all the countries of the world. I am, therefore, glad that this Conference has taken up this important topic for discussion. In India, in fact, it is important for us at this stage to take stock of this situation and formulate certain policies as regards the future set-up of this phase of medical education. Quite a divergence of opinion prevails on the various aspects of this problem especially as regards what our training programmes and policies should be for producing our future specialists, teachers and research workers. A lot of difference of opinion, for example, exists on the question of whether those going in for specialities should also undergo training in general disciplines before they start their specialisation studies and, if so, how much the training in general disciplines should be. I do hope that this conference would clarify thinking on various controversial matters and will help in formulating such policies as regards the organisation of postgraduate courses in various subjects as may result in the production of better teachers, well-trained specialists and real research workers.

I may now take up the various points on which discussions have been invited in the various sections.

formulae the merit may seem to be almost equal in a group of postgraduates, the quality of the students in that group differed quite significantly. It was often urged that we may have interviews, in addition to judging such students by their academic career alone, and that we should also get reports from their previous teachers on their ability and suitability for undergoing such courses. However, an interview lasting 15 minutes to half an hour or so cannot be considered superior to judgement based on the evaluation of a career of 5-6 years howsoever competent the selectors may be in their judgement. Similarly, the opinion given by one teacher as regards the ability of a student cannot be equated easily with the opinion given by another teacher about his students as all of us have different temperaments and varying ideas about the relative importance of the many qualities that a student has been exhibiting. We are now going to try an experiment according to which we will judge the students on the basis of their careers as we have been doing so far and call for interview for each subject, in which a postgraduate course is available, double the number of students than the seats that are available in that particular course. If, for example, four seats are available in any course, we will call eight top candidates selected on the basis of their academic careers. They can then be interviewed for three or four days in the laboratories and in the wards by senior teachers experienced in this type of work. It is hoped that selections based on merit as judged by an evaluation of the academic record as well as on the basis of observation of the knowledge and technical skills, etc. exhibited by the candidate may improve the quality of postgraduates that we admit. It will naturally take us a few years to evaluate the results of this experiment.

(2) *Duration and contents of course*

I have discussed this question in a separate paper. So, I need not repeat my observations on this subject here.

(3) *Methods of training*

In clinical subjects those methods of training should naturally be given preference which might enable the postgraduate by the time he finishes his course to attain such a standard that he is capable, after further training, of becoming a specialist in that. He must, at the same time, be initiated into methods of teaching as well as research so that he may be capable of becoming a future teacher, and contributing his share to future research in medical sciences while working as a teacher or a specialist.

It has been found by experience that so far as clinical training is concerned it can achieve the best possible results by giving responsibility of patients' care to the postgraduate students. Attendance at ward rounds, clinical conferences, demonstrations, seminars, etc. is no doubt very helpful for acquiring new knowledge but, unless a student has responsibility for the routine and emergency treatment of the cases under his care, he is not likely to achieve high standards of efficiency as a physician. Purely didactic teaching is not likely to achieve much at this stage of the students' career. The postgraduate trainee has already reached a stage when he is capable of comprehending books and journals and should, in fact, be fond of the library. Didactic teaching for postgraduates, in fact, should be such as to inculcate in the

student's mind the habit of learning things for himself from various sources. Thus, journal clubs, etc. are often of greater use than didactic lectures, though an experienced lecturer may utilise his lectures for presenting the latest advances and the latest thinking on some facet of the subject and thus help the student in learning the subject as a whole for himself. The training programme that we have so far developed at the All-India Institute of Medical Sciences for postgraduate students in medicine is being appended herewith (Appendices I and II). I do not mean to say that this is perfect and does not need any further improvement, but it is being appended only to stimulate thinking on how further improvements in this field may be effected.

The training period for postgraduates is rather limited and short. It is, so far, only two years after a house job, out of which a fairly hig portion is being taken up in working for and writing a thesis. So, it has been found difficult to introduce more training than what is mentioned in these appendices. Initiation into methodology of research is essential because from this very group we are going to produce our future scientists and research workers *Our practice at the Institute is that the subject of thesis should be such that the* postgraduate student works actively either in the experimental field or in the laboratory. Thus, he gets into the habit of sitting and working in the laboratory. Thesis writing, moreover, creates an interest in using the library intensively and is thus very beneficial in inculcating the habit of wide reading and looking for references on various subjects. For these reasons, if for nothing else, we should not give up thesis writing at this level of the training of medical graduates.

(4) *Teaching of pathology and basic sciences in the curriculum*

Training in these sciences is essential for those going in for M.D. in Medicine. So far as teaching in pathology is concerned, it really forms a portion of the training in the clinical disciplines itself as training in a clinical discipline is obviously incomplete unless the student knows the pathology of the various clinical entities that he comes across. It will be noticed from the appendices that our students regularly attend surgical pathology conferences. In addition, a lot of training in pathology is imparted in C.P.C.s, Grand Rounds, Radiology Conferences and so on. Questions on pathology and microbiology form an integral portion of the general medicine question papers. Clinicians must also see while teaching a clinical entity that its pathological aspects are inculcated into the mind of the student.

So far as the basic medical sciences like physiology, biochemistry and certain applied aspects of anatomy are concerned, it is essential to impart their knowledge to a certain extent to a postgraduate student. It may be done by giving introductory lectures in these sciences. It may be done in an applied way by stressing the physiological and biochemical basis of certain disorders. Metabolic and endocrine disorders, various function tests, etc. provide special opportunities for correlating the basic sciences with medicine. Biochemistry is playing an increasing role in the understanding of various disease conditions and, in fact, has started the reversal of the trend towards acquiring knowledge of specialities pertaining to various systems, for it is bringing home to the student's mind that most of the disease processes have a biochemical basis and medicine cannot be compartmentalised into various systems.

Unluckily, our teaching at the undergraduate level of this all-important subject needs a lot of improvement both at the pre-clinical as well as at the pre-medical level That is, however, a separate subject and I need not go into it at present. While a lot of help from teachers in basic medical sciences can be taken by arranging joint conferences with them and arranging some lectures by them, it is for the teachers in medicine itself to be conscious of the importance of these subjects for a student of medicine. We should give the students the concept that the knowledge of such sciences is essential for understanding the scientific aspects of clinical medicine. Much of this learning has, of course, to be done by the student himself.

There is some difference of opinion as to whether training in these sciences should be specified to a certain portion of the training programme. It has been suggested that it may precede the clinical training. I am not in favour of this idea. Training in the basic medical sciences should be concurrent with clinical training. Otherwise the student thinks that he has finished one portion of his career and has started another. If they are concurrent, it will help him to integrate one with the other and learn the application of these sciences to the understanding of disease processes.

Writing a thesis involves laboratory work in the biochemistry, pathology or microbiology laboratories and further helps in creating a bias towards the learning of basic medical sciences in the minds of students in clinical disciplines. Moreover, it helps them in learning certain techniques in these sciences.

(5) *Thesis or dissertation as requirement*

I have discussed this matter under item 3 briefly. I am not in favour of reducing the level of thesis to that of a dissertation. We should insist on the student undertaking work of a proper thesis involving research methodology even if the research is only a repetition of what has been done elsewhere and thus confirmatory and not original in character. In the U.K., thesis forms portion of M.D. and M.S. examinations but is not a requirement for the M.R.C.P. or F.R.C.S. examinations which are essentially examinations of a high standard for testing clinical knowledge. In this country, both functions, viz. testing for adequate knowledge of research methods as well as clinical ability, have been combined in the M.D./M.S. examinations as it is not possible to prolong the course indefinitely and so separate the two functions distinctly. In fact, it is better not to separate them, for, every teacher and specialist should get the concept that he is going to be a research worker also whether he becomes a specialist or a teacher or both.

As I have said above, in my opinion the thesis allotted to clinical students should be such that an appreciable amount of laboratory or experimental work is included in it so that the postgraduate student begins to appreciate the value of scientific approach for the elucidation of any clinical problem A lot of thesis writing in this country at the M.D. level is being based on the collection of data, during the routine investigations of the cases in the wards. The data are often collected from the various laboratories to which material from such cases is being sent during the clinical investigations of the cases by the physicians. This practice should be condemned and the plan of the thesis should be definitely formulated in such a manner that the essential investigations on the cases are undertaken by the postgraduate student himself.

The thesis should entitle the students only to become eligible for M.D./M.S. examination. It is only at the post-doctoral level that degrees may be granted on the basis of thesis alone.

(6) *Methods of Assessment*

I have already written a separate article for this conference on this subject and so I need not repeat all that in this paper.

APPENDIX I

DETAILS OF POSTGRADUATE TEACHING FOR DOCTORATE IN MEDICINE AT THE ALL-INDIA INSTITUTE OF MEDICAL SCIENCES

The syllabus is given in Appendix II. The students are admitted for postgraduate training (M. D. Medicine) every six months (July and January of each year). The total strength at a time remains less than twenty-four students. The training period for each student is of two years. Applications are invited from all over India and the admissions are made on the basis of merit as judged from their academic records during their M.B.B.S. studies. The students must have done their rotating house jobs plus a post-registration house job of one year or some equivalent jobs at this Institute or some other hospital recognised by the Institute for this purpose before they become eligible for admission to the M. D. course.

(a) *Block assignments:* The posting of the postgraduate students is distributed according to the following schedule

(i) A total of nine months posting under the Chief Supervisor of the thesis of the student.

(ii)* Posting for three months in the Department of Cardiology if the Professor of Cardiology is not the supervisor.

(iii)† Posting for three months in the Endocrine and Metabolic Unit of the Department of Medicine if the Associate Professor of this Department is not the supervisor.

According to the above schedule each student gets a minimum posting of one year in the unit of Professor of Medicine.

(a) *Training programme:*

(i) *Thesis:* Each student carries out a modest research work under the direct supervision of one or more supervisors and writes a thesis on the subject *in partial fulfilment* of the requirements for Degree of Doctorate in Medicine. Complete case work-up and the investigative procedures on the patients included in the study are done by the student himself.

Once in three months the progress of the thesis is reviewed by a formal presentation before the postgraduates and the staff of the Department of Medicine.

* Department of Cardiology has so far been treated as one of the medical units, as it admits general cases in addition to providing specialist facilities for cardiology.

† This unit is under an Associate Professor of Medicine—who has special interest in metabolic and endocrine disorders.

(ii) *Didactic lectures:* At the beginning of the two years' training period approximately twenty-five lectures are given on the subjects of basic medical sciences by the senior members of the staff in their respective fields. A few non-scheduled lectures on recent advances in the field of medicine are delivered during the course of two years by the staff of the Department of Medicine, if they so desire.

(iii) *Journal Club:* Twice a week by rotation students prepare and present a paper on preselected topics in the journal clubs organised by the Department of Medicine and the Department of Cardiology respectively.

(iv) Short periods of teaching are arranged in the following departments for all the postgraduates of the Department of Medicine:

Ophthalmology (Medical)
Radiology
Dermatology and Venereology
Psychiatry
Paediatrics

(v) *Radiological conferences:* Once a week a combined clinical radiological conference is held on interesting and complicated case problems.

(vi) *Clinical training:* This forms the central core of postgraduate training in medicine. It is organised according to the following schedule: Professor of Medicine unit, programme is given below and an almost similar plan is followed by the Department of Cardiology and Endocrine and Metabolic Unit of the Department of Medicine.

(a) *Bed allotment:* Each postgraduate student is allotted five to seven medical ward beds. The student independently works up the patient, writes his initial notes on the case sheet and then maintains the follow-up of the case along with the house physician in charge.

(b) Complete clinical study including management and follow-up of the patients included in the research study.

(c) *Casualty ward posting:* Students are posted round the clock for one month in the casualty ward. Students are directly responsible under supervision of an Assistant Professor for the complete work-up and management of the patient.

(d) *Private ward position:* One-month posting is arranged in the private ward to study and follow up the patients admitted under the Professor of Medicine unit.

(e) *Emergency posting:* On an average twice a month round-the-clock rotational posting of the postgraduate is arranged on serious cases. The number of such postings depends upon how many emergencies arise in the wards.

(f) *Out-patient posting:* Two forenoons a week a postgraduate works for about four hours in the out-patient department. He examines approximately ten new cases and nearly the same number of his own old follow-up cases on each day of his posting. He is responsible for the treatment and follow-up of these cases. He consults the Assistant Professor when necessary.

(g) *Speciality clinic posting:* Three afternoons a week each postgraduate attends speciality clinics of respiratory diseases, gastroenterology and neurology. In each speciality clinic on an

average each postgraduate works up two to three new cases and follows up his old (four to six) cases. Each speciality clinic conducts a discussion on clinical problems at the end of the clinic programme.

(h) *Ward rounds:* Teaching ward rounds for approximately two hours each are conducted twice a week by the Professor of Medicine and once a week by the Assistant Professor of Medicine.

(i) Clinical case conference is held twice a week.

(j) *Combined round:* Once a week the Medicine Department in collaboration with other clinical and paraclinical departments organises a combined case conference for the postgraduates of all clinical departments including those of the Medicine Department.

(k) *Surgical-Pathological conference:* Once a week the students participate in the surgical-pathological conference organised by the Department of Pathology.

(vii) *Training for teaching of undergraduate students:* By a rotation programme students are given responsibility of bed-side teaching of fifth and sixth semester undergraduate students during their postings in the wards.

(viii) *Clinical grand round or C. P. C.:* Postgraduate students attend the clinical grand grounds or C P.C. organised by clinical departments in collaboration with paraclinical departments.

APPENDIX II

SYLLABUS FOR M. D. GENERAL MEDICINE

The course shall comprise a minimum of two years' training and that for an employee of the Institute or one who is employed on a research scheme three years' training. During this period the student shall be deemed to have:

(1) Acquired an up-to-date knowledge of fundamentals of basic sciences as applied to medicine.

(2) Acquired a fairly good knowledge of internal medicine—both in theory and clinical.

(3) Competence in conducting investigative procedures.

(4) Working knowledge of some of the more common instruments and research techniques.

(5) Familiarity with modern methods of teaching undergraduates.

Thesis: Each student works for and writes a thesis on a research problem allotted to him. He works under the personal supervision of a faculty member who is his supervisor. There is often a co-supervisor also.

Didactic lectures: Didactic teaching is ordinarily kept at a minimum and no fixed set of lectures are given since it is felt that in a broad-based training at a postgraduate level it is not possible to define and cover the entire field of internal medicine. However, a few didactic lectures are given by faculty members mostly on recent advances in various systems. There is no fixed number for this. Lectures, as listed below, are being given at the beginning of a two-year period mostly on basic sciences and their application to clinical medicine:

(1) History of medicine.

(2) Breeding and maintenance of experimental animals.

(3) Anaesthetics for laboratory animals.
(4) Common experimental surgical procedures.
(5) Kymographic techniques in acute experiments.
(6) Principles of medical electronics.
(7) Colorimeter, spectrophotometer, pH meter and flame photometer.
(8) Electrophoresis, and paper chromatography.
(9) Isotopes.
(10) Frozen and paraffin sections, and staining technique.
(11) Histochemical techniques.
(12) Methods of study of cell injury.
(13) Sex chromatin tests and chromosome analysis in the study of disease.
(14) Experimental production of pathological states.
(15) Tissue culture.
(16) Genetics.
(17) Biophysics.
(18) Role of epidemiology in research.
(19) Perfusion techniques.
(20) Method of drug administration
(21) Log dose response curve.
(22) Statistics.

Journal Club: Once a week in medicine and once a week in cardiology, each student in turn is assigned a subject which is chosen by one or more faculty members of the department. The student is given enough time to prepare the subject and go through as many up-to-date references as possible. This gives the student a practice in understanding and preparing a subject scientifically and in presenting the data before others.

Clinical training: Each student is allotted ward cases and is given responsibility for these cases. In addition there are:

(i) Three bed-side demonstrations a week.
(ii) Two teaching rounds a week in the medical wards with the Professor of Medicine.
(iii) Students are rotated for clinical training in the following medical specialities for a period of three months each: (a) Cardiology. (b) Metabolic and Endocrinology Unit.*
(iv) Students are given a course of lecture demonstrations in the following specialities as indicated below:

1. Dermatology and Venereology including Leprosy ...	10
2. Psychiatry	9
3. Radiology	15
4. Ophthalmology—for fungus examination, etc. ...	10

*Training has been provided in the Neurology Department also after this paper was read.

(v) Each postgraduate attends M.O.P.D. service twice a week.

(vi) Each postgraduate attends three speciality clinics a week in turn and thus during the period of two years he rotates through all the major speciality clinics.

(vii) Attendance of all the postgraduates at the special medical and radiological conferences which are held once a week is compulsory. These are attended by physicians, surgeons and radiologists.

(viii) Combined rounds and grand rounds are held once a week each. Attendance at these is compulsory. The postgraduates are encouraged to present and discuss the cases in the above exercises.

Research review: On alternate weeks the faculty member incharge of the student discusses his research plans (thesis work) with him. This gives an opportunity for constructive criticism as well as a practice to a student of presenting scientific data before others. Research being done by postgraduates and teachers is also reviewed at group meetings.

Attendance at post-mortem: Attendance of the postgraduate at the post-mortem on medical cases is essential. He also attends surgical pathology conferences.

Undergraduate teaching: Every postgraduate takes part in undergraduate teaching especially bed-side demonstrations under the supervision of a faculty member in his early stages.

METHODS OF SELECTION AND REQURIEMENTS OF POSTGRADUATE STUDENTS

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MEDICAL educationalists, particularly in the last ten years, have become aware of the need for continuing the education of a physician. Intensive formal programmes, specially designed for the man in private practice, have become a standard technique of postgraduate medical education. This has been accomplished in some countries in the West by mobile educational teams. A team of 4 or 5 men goes out motoring from community to community giving instruction at important centres.

The purpose of the present paper is to discuss another aspect of postgraduate education in medicine, the fundamental purpose of which is to ensure to the public, both lay and medical, that the physicians claiming to be specialists do in fact possess the qualifications they claim, a claim which presupposes special training and success at the postgraduate examination.

Specialists in medicine are required as teachers of medicine to train the rapidly expanding present strength of 11,000 new entrants every year in the 80 medical colleges most of which are new as research personnel in the research institutions, specialists in the army medical corps where the demand has increased manifold due to rapid expansion of our armed forces, and as medical specialists for the district hospitals, for the railways, and for other public institutions and last, but not least, as consultants in private practices.

In the U. K. the postgraduate education in medicine is imparted in medical schools affiliated to their respective universities and the M.D. degree is regarded as the hallmark of scholarship and academic distinction, while the Royal Colleges of Physicians play an important part in ensuring the highest standard of postgraduate medical education. The success at these examinations only makes a person fit for further training before he is selected as consultant. In America and on the Continent, emphasis is primarily laid on the training that the postgraduate gets in specially selected hospitals with speciality boards to supervise and maintain the standard. In the U.S.S.R. only the best students are selected for postgraduate studies and medical research. They pass through the stages of two years as interns or 'ordiaturas' and then as 'aspiranturas' for one to two years and later as 'candidates of medical science' and finally as 'doctors of medical sciences' after 3 to 4 years of advanced work under the guidance of a professor. Only a few are entitled to be 'academicians'.

Based on the experiences of other countries and conscious of the heavy demands made on us during the phase of rapid developments in our own country, we must first answer the question whether we should or should not have two grades of specialists—senior specialists qualified as 'doctor of medicine' for the teaching and research assignment and junior specialists with diploma in internal medicine for the specialists' posts in district hospitals as an experimental measure for 10 years to tide over the present shortage of specialists.

I would personally feel that the number of available postgraduates would easily be doubled or even go higher if the appalling failure rates at these examinations could be cut down by better selection and a planned intensive whole-time training of the postgraduates instead of having two grades of specialists. Without going further into this controversy, I would confine my remarks to the methods of the selection and requirements of postgraduate education in medicine of the highest order for all categories of specialists.

There are at present no fixed criteria of selecting candidates for postgraduate education in the medical institutions. Some institutions would accept anybody who applies for post-graduation as long as he is an M.B.B.S. and fulfils other criteria. Others accept only those who obtain over 60 per cent marks in medicine irrespective of their performance in other examinations. There are others who take into consideration the results of all the professional examinations for final evaluation of the students. A student is supposed to spend three years after graduation for appearing in M.D. examination and this is the standard practice with practically all the universities, but some universities include during these three years the rotating internship while others count three years only after full registration. There are others who insist on one year's house physicianship but some universities ignore this condition.

Some universities insist on whole-time attachment of the candidates to the department; other universities only insist on six months' attachment for writing a thesis.

There are universities which insist on the training in basic medical sciences with or without examination as one of the requirements for admission to postgraduate examination; others do not insist on such a training or examination. Although I agree that universities should have the autonomy to carry on their own experiments in medical education, it is our duty to discuss the principles of selection and requirements for postgraduate education, since it is obvious that all the graduates of the universities who take their M.B.B.S. degree are not fit to be postgraduates.

Selection

Selection for postgraduate education should be based on the performance of students in all the professional university examinations during their undergraduate medical career with greater emphasis on clinical subjects, especially medicine. Only those candidates should be considered who have passed the examination in the first chance but in special cases one failure could be ignored. Statistical analysis of the results of our own institution for the last seven years and that of another institution has convinced me that the top ten per cent of the successful graduates give the best performance during training and postgraduate examination results; next ten per cent are comparatively poor while those still lower down the ladder are unfit for postgraduate studies.

An opportune time for assessment of the candidate by the teacher is the period of one year's house physicianship when the physician under whom the candidate is working would be able to judge the merits of the young doctor with special reference to his knowledge of medicine, approach to the patient, critical attitude and research inclination.

The cadidates must present evidence of satisfactory moral and high ethical standard in professional work before they are considered for selection.

The final selection of the candidates for postgraduate education should be made purely on the basis of merits of the candidates after an interview by a board consisting of the professor of medicine assisted by his senior colleagues in the department, and/or the council of postgraduate education and research department of the college or the university.

Twenty-five per cent of those selected should be graduates of other universities. While judging merit, due consideration should be given to the confidential reports of the referee, preferably of the professor of medicine of the institution from where the applicant has graduated and worked as house physician.

The number of candidates accepted for postgraduation would naturally have to be limited depending on the availability of senior teachers in the department, the number of units, laboratory facilities and inter-departmental co-operation. Not more than four postgraduates for each year may be allowed per unit.

Requirements

Two years of full-time attachment to the department of medicine after post-registration and compulsory housemanship for one year should be essential This must include full responsibility for the in-patient as well as out-patient care. During the first year the postgraduate should also be given a problem for investigation which would form the basis of his thesis.

All the postgraduates should be whole-time workers in the department and those without any paid assignment should be given stipend for two years.

The postgraduates must have a sound knowledge of anatomy, biochemistry, physiology, statistics, pharmacology, pathology, bacteriology, etc. Such a training is but a means to the acquiring of the knowledge of internal medicine. Whether the postgraduates in medicine should be working for three to six months in basic sciences in the afternoons or only for six months needs discussion, although personally I would prefer the latter.

The postgraduates must be provided residence on the college or hospital campus so that they could devote all their time to the studies and patients' care and make full use of the college library and the academic atmosphere of the campus.

CONTENT AND DURATION OF COURSE

DR. P. N. CHUTTANI

MEDICAL educationalists have not reached unanimity about the content and duration of a course for training a postgraduate in general medicine. Although there is divergence of opinion on the subject even at the undergraduate stage, in the latter case, however, there is agreement that there should be a course of training with a fairly well-defined content. Should there be a course at all for postgraduate training? Before we discuss this question it would be worth while to examine the situation as it exists today (see Table I). *Except for Bihar and Karnatak, no university allows a candidate to appear in M.D. examination* till three years after graduation but most do not insist on a course of training with a defined content. The Punjab University insists on six months' attendance in a recognised hospital of which three months should have been spent in an intensive course of training specifically designed for this purpose. I presume we all generally agree the state of affairs up to date has been unsatisfactory. Leaving aside a few exceptions, the training offered to our postgraduates is of poor quality generally. Not only have we to improve our facilities in the way of teachers, laboratories and number of beds but we have also to be clear as to our requirements. At present there are two modes of training. A large number of our students take their M.D. while occupying junior staff appointments, whereas others are full-time or part-time students During the last decade, as medical man-power shortage has developed and as price index has gone up, the latter category, viz. part-time or full-time students, has dwindled. Only the holders of stipends are now full- or part-time students. (The Government of India alone gives 300 such stipends for a period of 2 years.) An attempt has been made to give them a course of training during this period but it remains unsatisfactory in most places because of overcrowding of hospitals and shortage of staff. However, All-India Institute of Medical Sciences has been giving a two-year training to these postgraduates for some time and we might examine it in some detail. *It consists of four academic sessions with biannual intake. A thesis is required* and the plan is approved by the faculty before the work is started. Postgraduates are allotted beds and they have to study and investigate their patients and go round with their chief twice a week. They also do out-patients twice a week and special clinics 2-4 times a week. Interesting cases are discussed by the chief for an hour or so. Bedside demonstrations for an hour are held once a week. Radiology conference is held once a week when the clinicians (including postgraduates) discuss problem cases with the radiologist. Combined clinical rounds, clinics, pathological conference, journal club meeting are held once a week. Clinical demonstrations in dermatology, pediatrics and psychiatry are held once a week. Postgraduates also take part in teaching of undergraduates once or twice a week.

for six weeks during the first six months of the course. Our students work on their theses in the department of experimental medicine. Since we have no undergraduates, our postgraduates are encouraged to gain teaching experience by taking active part in group discussions of various kinds, by having symposia and panel discussions conducted by them with the staff present as the audience and by encouraging them to take bedside clinics of the interns under training. We had originally designed our training to spread over a three-year period but this period has had to be brought down to two years for reasons into which I need not go here. Although this programme has not yet had its full trial, some of us are already thinking of making a change.

Our broad plan is to integrate the intern, junior house physician, senior house physician, first-year postgraduate and second-year postgraduate into a four-year period of training. This, as you would have already seen, is not a new idea and is an adaptation of the so-called residency programme.

We propose to go further and reserve our registrarships for the brighter ones who go through our 4-year training programme. We expect the Registrar, who has done three years, would be fully trained and qualified to man a post of teaching physician of the level of an Assistant Professor at the teaching institutions. Since duties of a registrar are well known to you, I would not dilate upon them. He should be able to do everything that his juniors are supposed to do. In addition he should make himself available for consultations to his colleagues in the hospital and take active part in teaching as well as research

Why are we dissatisfied with the training of full-time students? Largely because we are convinced that it is essential for a doctor to handle clinical responsibility all along the line. It makes him not only a master in thought and action but spurs him to greater activity. It goes without saying that the clinical responsibility, unless effectively controlled, can leave little scope for personal study and thought but to ensure this we must depend on the teachers who have to provide a balanced training programme. You would have noticed that I have not referred to didactic training for postgraduates. It is best not to mention it because the only benefit it confers, I am convinced, is on the teacher.

TABLE I

PRESCRIBED COURSES FOR M.D. MEDICINE
(Inter-University Board 1958-59)

University Requirements

AGRA—Subsequent to graduation, 3 years in active medical practice (at least one year as houseman and one year in the teaching department).

ANDHRA—Total of 5 years after M.B.B.S.

or

3 years after M.B.B.S. out of which 2½ years should be in teaching hospital.

or

1½ years of hospital practice after M.B.B.S. for those who passed in first class.

BARODA—Duration of M.D. Course—2 years including one year of house job.

For admission to course, at least 2 years should have elapsed.

BIHAR—2 years after M.B.B.S. and one year after house job of one year.

BOMBAY—Part I—1 year after registration as a P. G. student.

Part II—2 years after M.B B.S.

Total duration of studies—2 years as a student or in approved appointment or combined.

DELHI—Total of 3 years. One year of house job, and two years as a regular student or in approved appointment.

GUJARAT—5 Years of continuous medical practice, one of which must be spent in regular postgraduate study. Relaxable under special circumstances.

KARNATAK—2 academic years after registration as a P. G. student.

LUCKNOW—Medical graduates of 3 years' standing.

MADRAS—Degree holders engaged continuously for 5 years in active medical practice

or

Hospital appointment for more than 3 years.

NAGPUR—One year's house job and then regular research and study for two academic years.

PATNA—After three academic years following graduation.

PUNJAB—Minimum of 3 years after graduation. House appointment for one year. Intensive course for 3 months at approved centres. Hospital attendance for—months.

TEACHING OF PATHOLOGY AND BASIC SCIENCES IN THE CURRICULUM FOR M.D. (MED)

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WHILE considering problems of postgraduate medical education in General Medicine, it is essential to be clear as to its aim. I feel that our aim should be to have "a scientifically trained physician, who will continue to be a life-long self-educator." Therefore education means expansion and extension of undergraduate education which enables a doctor who is not a specialist to become a physician in the speciality of General Medicine. If this is accepted, there will not be any two opinions about the desirability of teaching of pathology and other basic sciences to these postgraduate students. The point that needs a good deal of thought and discussion is how to introduce this teaching. In this paper I intend to present my views on this problem.

There are three ways in which the teaching of pathology and other basic sciences to the postgraduate students in general medicine can be done: (1) by organising a systematic well-knit comprehensive training course in basic sciences for a period of 12 to 18 months; (2) by making the postgraduate students work actively in the various sections of departments of basic sciences, by assigning them responsible posts for a limited period of 12-18 months; and (3) by ensuring that these students visit the departments of basic sciences throughout their training period for discussing their problems. This can also be achieved by arranging frequent meetings of the departmental staff of basic sciences and the clinical teachers.

Let us consider the merits and demerits, difficulties, limitations and feasibility of these three ways.

I. Organisation of a systematic comprehensive training course in various basic sciences by the departments of basic sciences:

This has many practical difficulties. All these departments, in every medical college, are now overburdened with undergraduate teaching due to increase in the number of admissions and paucity of teachers. If, in addition to this, such courses are to be arranged for all the specialities, then the task would be very difficult indeed.

Even if such a course is arranged, it will have all the defects of the didactic system of teaching and would soon become monotonous and uninteresting. Neither the teacher nor the taught would benefit from such a system. Therefore, I do not advocate this.

II. By making the postgraduate students actually work in these departments and by assigning them responsible posts for a limited period:

This has many advantages. It is practicable and mutually beneficial and hence is worthy of

serious consideration. For example, in pathology and bacteriology, postgraduate students can usefully and profitably work in autopsy room and in the sections of clinical pathology, chemical pathology and bacteriology. They can be given responsible posts like resident pathologists. Their work in autopsy room would make them better physicians, because they would be observing in detail the abnormal processes—the morbid anatomic aspects. Emphasis on frequent discussion aiming at correlation of autopsy findings with clinical manifestations of the cases would develop their powers of thinking and interpretation. Their work in other sections like chemical pathology, clinical pathology and bacteriology would train them in elementary techniques; much more than this, they will learn to evaluate laboratory data, and would at the same time know the limitations of laboratory investigations. If at this stage they could be tempted to undertake small investigative work, which may be a clinical problem requiring laboratory aids, the training would immensely benefit them.

I feel that their association with other members of the department and the postgraduate students of that speciality is bound to be mutually beneficial. With a little guidance from the senior members, an atmosphere for intelligent discussion between these groups can be easily generated and this is bound to benefit every one. Another advantage of having postgraduate students of different subjects working in one department is that in any departmental meeting, say, autopsy conferences, tissue conference, the subject-matter in question will naturally be discussed from different angles. Such meetings do then become interesting and instructive.

There could be two main difficulties in such a type of programme:

(a) Would it be possible for any department of basic sciences to accommodate these post-graduate students as regular members of the department?

I think that this is not a major problem because practically in almost all departments of basic sciences there are vacant posts. Furthermore, these students will be rotating in 4 to 5 departments. Assigning some of these posts to the postgraduate students of a different speciality, would also ease the burden of the department, if one could intelligently use these members in the undergraduate teaching and routine work.

(b) The allotment of regular work to such students will pose an important problem. Two things *need careful attention:*

(1) It should always be borne in mind that such postgraduate students have different interests and are not interested in intricate techniques of the laboratory. Hence, they must be posted in such sections in which they will be benefited most. It will be a waste of time, for instance, if such a postgraduate is posted in a section of virology, dealing with bacteriophage typing, or if he is made to work in the surgical pathology section burdening him with techniques of tissue processing and staining methods.

TEACHING OF PATHOLOGY AND BASIC SCIENCES IN THE CURRICULUM FOR M.D. (MED)

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WHILE considering problems of postgraduate medical education in General Medicine, it is essential to be clear as to its aim I feel that our aim should be to have "a scientifically trained physician, who will continue to be a life-long self-educator." Therefore education means expansion and extension of undergraduate education which enables a doctor who is not a specialist to become a physician in the speciality of General Medicine If this is accepted, there will not be any two opinions about the desirability of teaching of pathology and other basic sciences to these postgraduate students. The point that needs a good deal of thought and discussion is how to introduce this teaching. In this paper I intend to present my views on this problem.

There are three ways in which the teaching of pathology and other basic sciences to the postgraduate students in general medicine can be done: (1) by organising a systematic well-knit comprehensive training course in basic sciences for a period of 12 to 18 months; (2) by making the postgraduate students work actively in the various sections of departments of basic sciences, by assigning them responsible posts for a limited period of 12-18 months; and (3) by ensuring that these students visit the departments of basic sciences throughout their training period for discussing their problems. This can also be achieved by arranging frequent meetings of the departmental staff of basic sciences and the clinical teachers.

Let us consider the merits and demerits, difficulties, limitations and feasibility of these three ways.

I. Organisation of a systematic comprehensive training course in various basic sciences by the departments of basic sciences:

This has many practical difficulties. All these departments, in every medical college, are now overburdened with undergraduate teaching due to increase in the number of admissions and paucity of teachers. If, in addition to this, such courses are to be arranged for all the specialities, then the task would be very difficult indeed.

Even if such a course is arranged, it will have all the defects of the didactic system of teaching and would soon become monotonous and uninteresting. Neither the teacher nor the taught would benefit from such a system. Therefore, I do not advocate this.

II. By making the postgraduate students actually work in these departments and by assigning them responsible posts for a limited period:

This has many advantages. It is practicable and mutually beneficial and hence is worthy of

METHOD OF TRAINING FOR POSTGRADUATE MEDICAL EDUCATION

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OBJECTS of postgraduate medical education, as it exists today in our country, are to intensify the experience and knowledge of the medical graduate in the speciality of general medicine. This is so arranged as to include both clinical and theoretical knowledge leading to an academic degree. Therefore, the existing postgraduate medical education unavoidably suffers from limitations that are present in graduate education in our country, i.e. the methods are largely theoretical rather than a synthesis of theory and practice which is the hall-mark of true medical education. Our students are taught largely by lectures and opportunities for practical work are considerably limited.

To consider these objectives and to bring them in line with progressive medicine, the following suggestions are presented:

(1) Educational facilities should be so geared as to improve the speed and accuracy of learning. (2) The quality and efficiency of our work will depend on the knowledge and skill our doctors possess and the way in which that knowledge and skill are applied. (3) Medicine is a rapidly advancing science and efficiency demands that (a) our own medical scientists should be in the forefront of advancing knowledge, and (b) that those working as general practitioners should be helped to learn and change their practice in the light of ever-progressive knowledge.

Postgraduate education should not be confined to the short period during which a medical graduate works for his postgraduate diploma or degree, but should be a continuing process of learning, experimenting, and sharing of knowledge. If there is an atmosphere of curiosity, inquiry and liveliness, as well as a desire to learn from our experience and those of others, then we set the stage for postgraduate education. Programmes should be planned and time should be provided for doctors in order that they can participate in these programmes.

medicine can be undertaken with relative ease without any major disturbance and overburdening by the departments concerned.

(3) By ensuring that these students visit the departments of basic sciences throughout the training period for discussing their problems.

This can also be implemented without difficulty and like the second method it is mutually beneficial. This should be undertaken in conjunction with the second method, and should form a basic core of teaching throughout the entire period of the postgraduate education. Many such meetings are now held in practically all the teaching hospitals. Clinico-pathologic conferences, conferences on patient-deaths, regular combined autopsy conferences, combined clinical meetings, seminars, have now become regular features in many institutions. The mutual exchange of ideas and healthy constructive criticism and discussions at such meetings do stimulate the thinking mind. However, it is a common experience, that many a time our mind is not receptive and we do not think. This has to be guarded against It must be insisted upon that every postgraduate student actively participates in the discussion. Another drawback is that though departments of pathology, bacteriology, pharmacology, radiology, are included, physiology, biochemistry, anatomy sections are not represented in a good many meetings. Hence, the teaching of basic sciences suffers. I, therefore, recommend that this third method should be implemented in addition to the second.

Whatever methods we adopt for teaching postgraduates, we must realise that proper emphasis must be laid on developing a scientific attitude in these young persons. They must be taught to design experiments and to evaluate data.

Therefore, they must be encouraged to undertake actively small short-term investigative problems which require aids from basic sciences. Simultaneous attempts will have to be made to increase their power of expression. All this would help in developing their critical faculty which, in my opinion, is an essential attribute of a self-educator.

4. On the special clinical topics, statistical studies are presented and collected from the records of our hospital.
5. Weekly clinico-pathological meetings with case discussions and presentation of post-mortem specimens.
6. Pathology conferences with discussions in all post-mortem specimens.
7. Discussion on biopsy materials, with pathology group.
8. Weekly X-ray meetings.
9. Weekly Journal Club meetings.
10. Lectures and discussions by visiting professors.
11. Films and demonstrations by visiting professors.
12. Participation in research projects.

I have included training in research as the last among the 12 items but I wish to discuss something about this before I go on to other items listed because of its importance. Unfortunately, the incentives to continue research on clinical problems have not been sufficiently encouraged in our country. The incentive offered by educational organisations varies from university to university. Some universities have a programme of thesis on some research project included in the postgraduate curriculum, while in other universities it may be dissertation and in still others it is not included at all. The time that an examinee should spend on doing research will, therefore, depend on how much credit he is likely to get for writing a thesis. Likewise, if in the examinations the emphasis is on book-knowledge and clinical observations, the attention of the examinee will naturally be concentrated on what should help him in passing his examination. I feel postgraduate courses must include research as part of the curriculum and substantial credit should be given for such work. In order to promote research relating to clinical work some time should be allotted to basic sciences and postgraduate training should include these subjects in the training as in the examination. Perhaps, we need to emphasise here that the method of examinations should be modified so as to place importance not just on a short period of testing after 2 or 3 years of training, but also on observations and impressions of teachers made during the period of training. This change in the method of assessing a candidate is very important.

Among other topics mentioned above I may be asked to explain what we do with regard to the statistical analysis on special topics brought up for discussion. These statistical studies gathered from hospital records are important not only for reviewing the clinical work accomplished, but also to scrutinise the methods of keeping record and to effect modifications required in such records.

In pathology conferences and X-ray meetings, case discussions take place in the light of these special examinations. This indeed achieves a double purpose: first, it helps the service (or paramedical) departments in improving upon their service standards; and, secondly, the clinicians gain information and interpretation from the service specialists.

We have regular Journal Club meetings in which the staff including the students of postgraduate class review from time to time articles of interest and of importance from medical journals. These journals, covering a wide range of medicine, help to keep the whole group

THESIS OR DISSERTATION AS REQUIREMENT FOR POST GRADUATE MEDICAL EDUCATION

DR. R. SUBRAMANIAM, B. SC., M.D., M.R.C.P. (LONDON)

Professor of Medicine, Madras Medical College. Physician, Government General Hospital, Madras

AT present, in some of the Indian universities, for a postgraduate degree a student is expected to write a thesis, but in the vast majority of other Indian universities a candidate is asked to submit either a dissertation or twenty case sheets. In the universities where a student is required to write a thesis, it is given much importance and only if a candidate passes in the thesis is he allowed to proceed further with the examination. This means that a candidate must spend quite some time in studying the literature on the subject, and also do some original work which involves spending of time he would otherwise have spent on reading for the theory examination. This may be a disadvantage but the advantage is that the candidate gains practical experience in conducting research even in the early days of his training. He knows how to collect data and, being young, this gives him a good start in life in practical medicine, and at a later date when he becomes the head of department, he will be in a better position to guide the young research workers. Much has to be said for insisting on a thesis for a higher examination, but a candidate must be given relief from the theory examination. Since this work is the outcome of several months of sustained work, if the work is found satisfactory, it means that the candidate has done sincere work. If found unsatisfactory, the examiners can know without doubt that the candidate is not a good worker. In a theory examination, an intelligent candidate can always guess the nature of questions by a process of elimination of previous years' question papers and by taking extra interest in the work he has done he may be able to answer very well, though his knowledge of the subject may be shallow. But such a thing will not be possible if the subject-matter to be examined is a thesis. The examiners must be given sufficient time for examining a thesis. No more than one or two theses should be allotted to an examiner and he must be given at least a fortnight's time. He must be given adequate remuneration; his remuneration should not be the same as that of an examiner in theory papers. The system of sending too many theses is deplorable as most of these examiners are already overburdened with a heavy routine of teaching and hospital work. Though it may be too much to expect highly original work from a candidate who has just finished one year of house surgency, in any case a thesis will indicate his capacity to collect data and correlate the results. Even if he follows a beaten track, he would have collected something new, something that is not already available in the standard text-books. To illustrate, if a student works on the problem of myocardial infarction, the thesis may be graduate class review aspect of myocardial infarction only, like estimating the level of serum journals. These journal of acute myocardial infarction, or the socio-economic group in which

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acúte myocardial infarction occurs in a given area of similar problems. Though the work in these cases cannot be considered as extraordinary or original, it, no doubt, gives an information which will be of value for the clinicians in the locality. Even an abstract of the thesis, if published in a medical journal, will be of considerable value to the practitioners in that locality.

To take up the problem of dissertation. Here the candidate has to satisfy a set of examiners in several examinations, i.e. theory, clinical and then viva voce. If he devotes too much time to dissertation then he pays less attention to his theory papers. So, it should be realised that a dissertation will be much lower in its standard as compared to a thesis. No elaborate work should be expected. Since the standard that is expected is lower, so long as it is not of a bad quality or a pure copying work, the examiner should approve it But even in a dissertation a certain amount of originality is called for. The candidate may have to gather data on his own, utilising the hospital statistics spread over several years so that the data that are gathered will still be of use to the profession at large, though the usefulness may not be so much as in the case of a thesis. The subject on which the candidate works either for a thesis or for a dissertation can be the subject in which the candidate may specialise in the years to come. It may be left to the choice of the universities to insist either on a dissertation and have a number of theory papers or on a thesis in lieu of either all the theory papers or one of the theory papers. I am not at all in favour of case sheets being submitted for the higher examinations. To my mind, submission of case sheets is reminiscent of undergraduate standards. My experience as an examiner in several universities is that often candidates have a tendency to copy from the same case sheets. There is no provision by which one can say that a case presented by one should not be presented by another candidate. Sometimes the presentation has been more or less identical even with regard to punctuation marks. Where case sheets are approved, they are never taken seriously. No remuneration is offered to the examiners for going through these case sheets. No marks are allotted for the case sheets, with the result that the candidates themselves know that it is not to be taken seriously and a slipshod work results. No doubt an examiner can detain a candidate if he is dissatisfied with his work, but when the candidate has passed the theory, failing him on the case sheets appears to be unjust. Such being the position, I cannot understand why a candidate should be compelled to present case sheets. A candidate prepares twenty case sheets, with four copies. Even at a modest estimate, it costs a candidate Rs. 500. When a thing is not taken seriously, why should a candidate be put to such a heavy expense? It is totally uncalled for and should be scrapped immediately.

METHODS OF ASSESSMENT

DR. C. R. R. PILLAY

A postgraduate student is a potential teacher or consultant in medicine. An assessment of a postgraduate essentially means assessing an individual as best as possible, for discharging his future duties as a teacher when he will have to guide hundreds of medical students or else as a consultant in society when he will have to maintain a high level of professional efficiency. This immediately indicates a fundamental difference in the assessment of an undergraduate and that of a postgraduate student. And so, the methods of assessment of an undergraduate which have been discussed at various national conferences in the past may not be applicable in the case of a postgraduate.

One of the most difficult aspects of medical education is the assessment of a candidate, which is particularly so when we come to the postgraduate level. When one views our country as a whole and the set-up and pattern of postgraduate training, one sees the haphazard, ill-organised and disorientated approach which is bound to cast a gloom on any one who is interested in the subject. There is every reason why we should be critical of the guidance and help meted out to these students. Paucity of full-time and experienced teachers and lack of staff and many other factors must have contributed to this deplorable position. In almost all the medical colleges the prime duty of the professors appears to be the teaching of undergraduates, and the teaching of the postgraduates is done rather casually. Such a state of affairs is bound to have a had influence on the overall standards of the students and this in turn will have a tangible effect on the proper assessment of their ability.

Some of the basic questions that crop up in relation to this subject are the following:

(1) What are the present methods of assessment?

(2) What are the inherent drawbacks in such methods?

(3) What possible modification could be envisaged so that a better assessment is possible?

Let us have a look at the present methods of assessment in a majority of the centres in India. In almost all the universities, the postgraduate student is expected to submit a thesis at least three months before the examination. This means that his thesis is the result of work for about 18 months. What is the value of this thesis? Is this valued and graded and is this grading taken into consideration in the final assessment of the candidate? I venture to say that the usual approach in a majority of the universities is that the grading of the thesis is not taken into consideration in the final analysis. In some places candidates may be debarred from taking examination if the standard of the thesis is poor but no credit is given for the good work. This has a negative effect on the candidate: he does not put his best in the work since he knows that it will not be counted in the final assessment. An important piece of work done by the candidate during the course of 18 months or a major part of his postgraduate study is not given the due merit or recognition it deserves. In this connection it is pertinent to point out that the equipment and facilities to carry out scientific work differ so much from centre to centre and

even from institution to institution that there may be a wide disparity in the nature and types of work done by the candidates.

The examination paper usually consists of written, clinical and oral parts. The written examination consists of three papers of three hours eaeb. General opinion now favours the abolition of a written examination. At the postgraduate level I feel that the written examination has a definite value and place. It helps one to know how far an individual can arrange facts and present them propeily. Conceding that the written examination is a necessity at the postgraduate level, the next problem is the proper grading of the answers. Proper grading naturally depends on time given in going through the papers. If the written examination is immediately followed by the clinical and orals, there may not be sufficient time for an outside examiner to go through the papers completely and diligently. Hence, it is imperative to give sufficient time after the written examination. And this is particularly necessary nowadays when the number of candidates appearing in each centre is increasing rapidly.

The validity of holding an examination at the end of one year in the basic sciences as physiology, biochemistry and pathology is debatable. This intermediate examination before the final is bound to affect the clinical studies in the first year. Since clinical medicine is what it is today, it will be more satisfactory if these basic subjects are integrated and incorporated in the final assessment of the candidate.

In the majority of centres the *viva voce* is taken and treated as an unimportant appendage of the whole examination. Usually, once the candidate has made his grade both in the written and in the clinical examinations, the oral examination is conducted rather casually. But it is easy for any one to understand that *viva voce* could play a very useful part in the overall assessment of the candidate. His reaction, response, breadth of knowledge and his personality, could all be judged during this phase of the examination.

Periodical examination and personal assessment of individual candidates at the postgraduate level is a far cry in India at the present time because of the background of and definite drawbacks in our set-up.

The selection of examiners is an important factor in the proper assessment; super specialists in the line should be as far as possible, avoided for general medicine. But the rapid increase in the number of centres for postgraduate examinations may, to some extent, vitiate this problem of getting the right type of examiners. It is also important to scrutinise the number of centres an examiner is visiting both for the undergraduate and the postgraduate examinations, because I feel that, in the proper assessment of a candidate, the examiner should not have a mental fatigue produced by frequent examinations. The number of outside examiners is also important in this context. If there is a set of four examiners, it will be desirable to have two internals and two externals, particularly if they conduct examinations in two different batches.

Having gone through the exsiting system of assessment of the postgraduate student, it is relevant to have an idea of the main drawbacks of the system. Of course, the inherent drawback of the present system of examinations which do not take into account the uniform performance of the candidate at periodical intervals is ingrained in the present method. We are judging a candidate in the artificial atmosphere of examination on his performance

on a single day. And, again, the pressure of time because of the increased number of candidates naturally curtails our ability to assess the student properly. One way to tackle this particular situation is not to call more than 10-12 students on a single day for the clinical examination.

So, on the whole, when one views the assessment of the postgraduates, one feels that various factors stand in the way of sound judgement. But then in our present set-up one wonders as to what else could be done except to have minor modifications in the existing practice. To a great extent, proper assessment will depend upon a well-thought-out and planned procedure for the training of the postgraduates throughout the country. Giving credit to the thesis and giving more time to the examiners for evaluation of the written papers may help us to judge these a little better. No spectacular changes are at present feasible and perhaps not indicated.

REPORT OF THE SUB-COMMITTEE ON GENERAL MEDICINE

Dr. K. L. Wig

Chairman, Director All-India Institute of Medical Sciences, New Delhi

Dr. C. R. R. Pillay

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SELECTION OF CANDIDATES

CANDIDATES eligible for this course are M.B.B.S. graduates with one year of rotating compulsory house-surgeoncy followed by one year of post-registration house-surgeoncy. Selection should be based on merit and on the assessment of the candidate at the interview. After the preliminary selection, candidates should be observed and assessed for six months when those who are unfit for the course should be rejected.

DURATION AND CONTENT OF THE COURSE

The duration of the course shall be at least four years, i.e. three years after one year of post-registration house-surgeoncy. Besides regular bed-side teaching, there should be clinico-pathological conferences, journal clubs, case conferences, statistical meetings, radiological conferences, symposia and seminars.

METHODS OF TRAINING

There should be in-service training. Stipendary and other postgraduate students should also be accepted for some time to come as there are not enough posts for in-service training in many of the universities and medical colleges. Postgraduates training in rural areas should be taken up by only those institutions which have adequate facilities. Postgraduates should be given experience in teaching.

TEACHING OF PATHOLOGY

The aim of teaching pathology and the basic sciences should be to make postgraduates scientifically oriented clinicians rather than clinical scientists.

POSTGRADUATE EDUCATION IN SURGERY

Dr S. J. Mehta, F.R.C.S.

THERE is an overall deficit of medical personnel in the country, particularly of the postgraduates. Hence, there is a lack of teachers and clinicians. The emphasis, therefore, in any training programme should be to produce clinician-*cum*-teachers.

2. Much is being said of research and research workers. But at this stage emphasis on research is misplaced because our need at present is to get more clinicians and teachers. Research and research workers can only be had if there are trained postgraduates; they can never be "made to order." Then again there are misconceptions about the term "research" which can be clinical, epidemiological, statistical, etc., i.e. both applied and theoretical.

3. The economic factor as far as students are concerned has to be kept in mind An unduly long period of postgraduate training will defeat the above purpose. The aim should be to produce a trained and qualified postgraduate by the time he reaches the age of 28 or 30. A longer period of postgraduate training is an economic burden and is probably unnecessary in the present context.

4. As at present, we have no real system of assessment and selection of candidates for postgraduate studies. Any candidate who passes his M.B.B.S. can register himself as a postgraduate. There is no system whereby he can decide or others can decide on his behalf whether he should take up postgraduate course in medicine. The result is a percentage of fall-out on the way, and another percentage merely acquires a degree and is not of a calibre to contribute materially to future teaching, research or high standard of clinical work.

5. By and large, there is no organised and phased teaching programme either in the institutions or in the universities. Teaching consists of delivering lectures to students and holding of haphazard clinical demonstrations.

6. Even then the primary aim of such theoretical teaching seems to be the acquisition of the degree rather than cumulative experience and training leading to a sound qualification. There is too much emphasis on the actual examination rather than on the overall assessment of the candidate during the years of training. The latter is not possible in the absence of adequate training programmes where personal evaluation is possible.

7. The other important drawback which will have to be surmounted is the lack of adequate appreciation by the authorities running the hospitals and medical colleges, about the necessity to adapt to changes. Often there is complete lack of coordination between the university authorities and the administrative authorities. As a result medical education suffers. It is, therefore, necessary that all such authorities be ready to understand the problems, alter old set patterns, effect coordination, and secure financial resources.

8. General surgery now is more or less a speciality by itself and the other specialities

like urology, neurosurgery, orthopaedic surgery, thoracic and other branches are part of this discipline. It has, therefore, to be treated and organised on this basis.

REQUIREMENTS OF STUDENTS

(a) Candidate must possess the M.B.B.S. qualification of a recognised university.

(b) He shall register for postgraduate surgical training but not specify at this stage whether it is general surgery or in the specialities.

(c) Before the training of general surgery (or speciality) he shall have served in residency and rotating internship appointments for 1½ years. The period of each internship may be 3 to 4 months.

(d) During this period of 1½ years the candidate should have served in appointments in any of the clinical departments. This will afford the candidate the opportunity to decide for himself whether to pursue postgraduate surgery and, if so, what particular branch of surgery he should specialise in.

(e) At the end of 1½ years the candidates may choose the speciality for the final degree of *M.S., i.e. general surgery or one of the specialities (or equivalent board qualification)* and should register for the same.

(f) The training programme should be for 3½ years after the acceptance of registration.

SELECTION OF CANDIDATES

(a) No special selection is required for the first phase of programme which is of a general nature.

(b) The importance of selection is felt only thereafter when the candidate is about to enter the general or speciality surgery training programme.

(c) The number of candidates to be accepted for each programme is entirely dependent on the organisation and set-up of a particular department of an institution.
As a general policy it may be suggested that in a unit of up to about 25 beds, with one senior and one junior surgeon tutors, not more than 8 candidates can be accepted.

(d) The selected candidates should be given designations, such as junior and senior registrars.

(e) The evaluation of the candidate should be made by a board constituted by the institution and comprising the heads of departments, and one representative each of the university and the authority governing the institution. In the selection of the candidate his overall scholastic career, width of interests, personal and confidential evaluations from chiefs under whom he has previously served and the general performance at the interview should be taken into consideration.

METHODS OF TRAINING

Certain broad principles of the training programme can be laid down:

1. The candidate should have a broad-based training in the subject including overlapping areas of medicine, pathology and other specialities.
2. During the training period of 3½ years, the candidate should work on a full-time residency basis in the unit concerned. He should take part in all activities of the unit, such as participation in seminars, conferences, teaching assignments and such other duties as assigned to him by the chief.
3. The training programme should provide for graded responsibility devolving on the trainee during the course of 3 years, so that at the end of that period both the trainee and the teacher feel confident about the former's ability to practise the speciality.
4. Personal observations by tutors and periodic assessment of progress must be carried out and noted in the candidate's confidential record.
5. In the initial 6 months of the programme, the candidate should be made to concentrate for some time on basic sciences and pathology. This part of the training can be common to all specialities and basic sciences departments should be organised to formulate and effect such a programme. During the period of coaching on basic sciences the candidate must concurrently carry on with the departmental duties. A tutoring period of 3 to 4 months in basic sciences should suffice. Such tutoring should be given only by recognised and established departments of basic sciences.
6. The trainee must be encouraged throughout the 3½ years to habituate himself to read the reference literature and other books or he should visit the pathological, biochemical and other ancillary departments. He should be encouraged to carry on animal experimentations whenever facilities are available.
7. There should be regular seminars and meetings in the departments and with other departments, where the trainee should be initiated into the methods of presentation and discussion of scientific meterials.
8. During the training period, if desirable, the candidate can be seconded for a short period to other speciality units for specific purposes at the discretion of the teachers, e.g., a general surgery candidate may be seconded to other speciality surgical departments if found deficient in any of them.

CONTENT OF COURSE

In principle the training should embrace:

(i) Clinical work, both in-patient and out-patient work and follow-up of cases.
(ii) Training in the evaluation of ancillary diagnostic procedures, e.g. radiological, pathological, biochemical, etc.
(iii) Assignment to other units which have overlapping interests with the subject of training.
(iv) Operative surgery with graded training and responsibility under supervision should be performed by the candidate, so that at the end of 3½ years he should be able to carry out most of the procedures on his own. It would be preferable for the candidate to maintain a record of the operative work carried out.

THESIS OR DISSERTATION

By definition a thesis is a "proposition to be maintained," i.e. it implies original thought and work. Dissertation means "discourse or exposition." It implies, therefore, merely observation and comments on work done. Under present circumstances it would be in the fitness of things for a candidate to submit a dissertation rather than a thesis. If, however, a candidate has been able to produce a thesis in the 3½ years of work then that should also be accepted.

METHODS OF ASSESSMENT

The objective of the training programme should be to produce a well-trained, reasonable, experienced and balanced clinician teacher. The result of the final examination should be based on the following principles:

1. Overall assessment at the end of 3½ years as noted by the periodic assessments of the candidate from the confidential records.
2. Record of clinical work.
3. Record of operative work.
4. Record of participation in seminars and conferences.
5. Record of papers written for seminars, etc.
6. The quality of dissertation or thesis.
7. Final certification from the teachers.

All these should be brought before the previously mentioned Board for discussion and approval.

EXAMINATION

1. *Written examination of 2 papers:*
   (a) General paper on basic sciences, pathology, biochemistry and other topics allied to the subject of training

2. *Clinical Examination:*
   (a) A ward round and discussion of cases. The candidate may be asked at the discretion of the examiners to undertake a sort of demonstration for teaching purposes.
   (b) Examination and discussion of selected clinical material.

3. **Viva-Voce Examination:**

   Discussion on the topic of training and allied spheres, interpretations of X-rays, pathological specimens, histological slides, etc.

4. **Operative Surgery Examination:**
   (a) Wherever possible a demonstration of actual operative surgery by the candidate should be witnessed.
   (b) Discussion on operative surgery topics.

DURATION AND CONTENT OF COURSE

DR. A. VENUGOPAL

Professor of Clinical Surgery, Madras

POSTGRADUATE training in surgery has proved to be a fertile field for discussion and has given rise to many problems as to the manner in which the postgraduate should be made familiar with the ever-increasing knowledge of medical sciences and the developments of various specialities. It requires, therefore, a good deal of thought and experience to adjust to the postgraduate medical curriculum in such a way that, while the student is not overburdened with unnecessary details and facts, which are not of much interest later, he is given an insight into the ever-increasing number of new discoveries and, what is more important, a taste in later life to equip himself with the knowledge necessary for the successful practice of the profession. The world is faced with many problems, social, economic and political, and the medical profession cannot afford to be in isolation without taking note of all these factors. In the postgraduate course for surgery, what is needed is a broad-based method of approach which will serve to make the postgraduate acquire the habits of study and a capacity for independent thinking, so that he may continue his medical education in any direction he may choose. This is of fundamental importance because unlike in many other professions the postgraduate cannot afford at any time to forget that he is a student or to ignore his studious habits.

These general observations may perhaps help us to form a concept of the duration and content of course in general surgery. In planning the course for surgery one must necessarily take into consideration those aspects of the basic sciences as well as the clinical subjects, which are relevant. Thus, for instance, embryology, anatomy, physiology, pathology, endocrinology, bacteriology and biochemistry must be considered. From this it will be obvious that the postgraduate training must be a judicious synthesis of these essential factors, so that the general training may be such as to enable a student to become a good general surgeon.

DURATION AND CONTENT

The applicant for post-operative training in surgery must have completed one year of internship. Following this, the candidate must have a minimum of three or four years of training in surgery in an institution or institutions acceptable to the university.

BASIC QUALIFICATIONS

The candidate after completing his undergraduate course must have served for one year as an intern in a recognised hospital. If his aptitude is for surgery, during this period, he should continue for one more year as a resident houseman. During this period, he should be posted for six months in the general surgical side, where he will learn the first principles of surgery.

During the next six months, he should rotate in all the specialities such as neurosurgery, orthopaedic surgery, urology, thoracic surgery and E. N. T.

SCOPE OF TRAINING

Training in general surgery should be broad-based and should preferably include some experience in closely related special fields of surgery. Large hospitals, which have speciality departments, could usually provide this experience by agreement with the chiefs of the two services to exchange residents for a definite period of time or by planning a rotation of assignment of residents to selected surgical speciality services.

Urology and orthopaedic surgery are the most commonly included. However, other surgical specialities may be considered, if the hospital has facilities. At least two years should be spent specifically in the department of general surgery.

Assignments for experience in special fields of surgery must, therefore, be limited in number so that the postgraduate can get the maximum out of those speciality departments, which can contribute most effectively to the general surgeon.

APPLICATION OF BASIC MEDICAL SCIENCES IN SURGICAL TRAINING

The application of the basic medical sciences should be stressed in relation to the clinical work of the residents throughout the whole training programme. The postgraduates should spend their afternoons in the basic sciences departments like anatomy, pathology, physiology and biochemistry. Frequent conferences for a detailed discussion of problem cases on the surgical service are important. Weekly or fortnightly clinico-pathology conferences must be attended by the postgraduates. The postgraduate student should study and discuss with the pathologist about the tissues removed at the operation and likewise all autopsy material.

Surgical anatomy should be stressed by the attending surgeons or guides in discussing surgical cases with the postgraduate. In addition, the postgraduate should have performed all minor and major operations during his residency training programme.

NUMBER TO BE ADMITTED AT A TIME

Not more than two postgraduates should be entertained at a time.

RESEARCH WORK

Research work offers an opportunity for understanding the application of basic sciences to clinical problems.

Exposing a student to research activities is recognised as an essential part of postgraduate education. Considering the fact that two years is likely to be a short period for fundamental research of any significance, a limited study of basic problems by animal experimentation and biochemical or bacteriological investigation is possible during this period. A study of case records initiated during this period of training will be most helpful for him to assess the clinical material and thus give him full opportunities for reporting his findings in the form of papers submitted for publication. Reasonable facilities for research work by the postgraduates should be provided together with stimulating guidance and supervision. In order that a

broad training in general surgery can be given to the postgraduates, it is absolutely necessary that the hospital should be able to provide an adequate number and variety of patients. A general hospital which is affiliated to give this training programme should be able to admit annually to the surgical department approximately five hundred cases.

Fifty per cent of the beds in the General Hospital must be earmarked for general surgery, At least a hundred and fifty beds must be allotted to general surgery so that the postgraduate who is a resident could have sufficient in-service training during the three-year period of his course. There must also be a large out-patient department, where postgraduates can get their basic clinical teaching. In-service training is absolutely necessary, as it will enable the postgraduate to have a progressive operative experience during his three-year stay. He must hold positions of increasing responsibility for the care and management of patients and have sufficient experience to acquire surgical skill and judgment through the performance of surgical operations involving a high degree of responsibility But at the same time he should be given adequate opportunity for consultation and advice.

POSTGRADUATE TEACHING

Postgraduate training and teaching should primarily be of an in-service type. The candidate must be allotted a certain number of beds in the in-patient area and he will be solely responsible for the pre-operative work which will include case study and investigatory procedures for arriving at a correct diagnosis. If operation is indicated, he will be solely responsible for the pre-operative and post-operative care of the patient; during this time he will be under the constant care and guidance of a senior surgeon.

DIDACTIC TEACHING

Formal lectures to cover the course of basic sciences and lectures-cum-clinical demonstrations must be conducted every week.

The students must take part in seminars and one of them must be prepared to take a major role during the presentation of the topic. Each postgraduate must be asked to report to the examiners, in the form of a summary, the articles he has read from journals.

SELECTION OF CANDIDATES FOR M.S. (GENERAL SURGERY)

COL. R. D. AYYAR

New Delhi

THE present methods of selection obviously are not satisfactory. This is borne out by the very low percentage of passes in the M.S. examination of the various universities. As failure means wasted effort, time and money for both candidate and the staff, it has become necessary to see whether better methods of selection can be evolved.

Apart from the result in the examination, another equally important aspect of the problem of selection is the end product of the training. What is it that we expect of an M.S. qualified doctor who has put in three years after graduation, two of which are spent in surgical training in a teaching institution. We should have a clear picture in our mind as to what this should be. In the present context of our country's needs, I suggest that after two years of intense clinical and practical training in a good teaching unit, an M.S. should be capable of diagnosing and treating all cases of acute abdomen, acute injuries to the head, chest and extremities and burns. If he is competent in this, there is no reason why he should not, in due course, be equally competent in the practice of "cold surgery" and, with further training, be proficient in the specialities.

If it is agreed that our immediate needs are for a large number of good practical surgeons who can tackle all types of emergency surgery efficiently, and not the type of pure surgeons as are turned out now, then our methods of selection have to be orientated to that view.

What then are the qualifications necessary for a candidate?

1. *Physical Fitness:* Today the life of a surgeon is very arduous and this is true especially of the first few years. In a busy hospital, a surgical registrar or junior surgeon may have to put in as many as 18 hours, 3 or 4 days in the week. Unless he has a strong constitution the candidate is likely to break down.

2. *Age:* At present I do not think that any restriction is placed on age. I feel this is a matter to be rectified. Time and again one sees candidates joining M.S. courses 10-15 years after graduation. The selection of these candidates, which is based only on their M.B.B.S. marks obtained ten or more years earlier is neither fair to the candidate nor to the teachers. Seldom do they qualify and even if they do so it is after making an unusually large number of attempts. I should like to suggest that a candidate who has not been in the practice of surgery for five years should be debarred from selection. By practice of surgery I mean major surgery and not just an occasional opening of abscesses.

3. *Previous professional experience:* In the Delhi University, the requirements are one year's house surgeoncy in a recognised hospital, six months of which must have been in surgery. While in Delhi hospitals the usual practice is to give six months in medicine and six months in surgery the practice obtaining in some of the other university medical college

hospitals is different. A rotating house surgeoncy of six months, which includes E.N.T. and perhaps orthopaedics, and anaesthesia, seems to be the rule. This disqualifies a candidate for admission to Delhi University M.S. degree. Sometimes a certificate of six months of house surgeoncy is issued even though part of the period has been spent in departments other than general surgery. I think a period of six months in general medicine and six months in general surgery (which may include two months in the out-patient department of orthopaedics) should be the minimum period of house surgeoncy acceptable. Further I would suggest that after the period of house surgeoncy the candidate must spend one year as a surgical registrar in a recognised hospital. At the end of this period, the candidate may be allowed to apply for entrance to M.S. examination on the production of a certificate of satisfactory work. If accepted, he should continue as a surgical registrar during the two years required for training in M.S.

Taking the average age of passing M.B.B.S. as 23, one year's house surgeoncy, one year's training as registrar and two years of training for M.S. will take him to his 27th year. With the present economic conditions prevailing in the country we cannot afford to prolong the period of training.

QUESTION OF MARKS AND ACADEMIC CAREER

The present practice is to give first priority to those candidates who have gone through the M.B.B.S. examination without failure taking into account the total marks in the final M.B. examination and marks in surgery. Sixty per cent was the minimum requirement. A couple of years ago we decided to give a bonus of 5 marks to those who had done one year as a surgical registrar in a recognised hospital. It has also been agreed that the candidates who have done two years as surgical registrars and whose competency is certified by the surgeon should be accepted irrespective of the marks obtained in M.B. examination. I feel marks obtained at the final M.B.B.S. examination are a less reliable guide to a candidate's aptitude for surgery than a report by a competent surgical teacher after 2 years of observation.

In conclusion, I would suggest that selection of candidates should be based on the following:

1. Age—not over 32 years.
2. Academic career and postgraduate training:
    (*a*) A minimum 1 year of house surgeoncy—6 months in general medicine and 6 months in general surgery.
    (*b*) One year as a surgical registrar to a surgical unit in one of the recognised hospitals.
3. Preferably candidates who have passed their examination at the first chance and who have obtained 60 per cent in the final M.B.B.S. examination.
4. Physical fitness.

POSTGRADUATE TRAINING IN GENERAL SURGERY

A. S. FENN, M.S.

Associate Professor of Surgery, Christian Medical College, Vellore

THE methods for training a general surgeon have undergone many changes during the last ten years in our college and what I am presenting below is in essence what is being parctised at Vellore.

The efficacy of this method is seen in the change brought about in the results of these candidates appearing for their M.S. degree in the Madras University.

No. of candidates for M.S. before 1954	9
Number who have secured M.S. so far	4
1st attempt	None
2nd attempt	None
3rd attempt	2
4th attempt	2
Number of candidates after 1954	16
Number who have secured M.S.	16
1st attempt	8
2nd attempt	3
3rd attempt	3
4th attempt	2

Aim

The aim of this training is not only to enable a candidate to secure his postgraduate degree, but also to make him an efficient general surgeon.

Type of training has to be an "in service" programme. The trainees are resident, they are paid, they take calls and are able to take an increasing responsibility in the care of the patient, teaching of undergraduates, and some amount of clinical research.

Time Requirement

We have found that a period of three years is an absolute minimum requirement. This is after two years of completing their undergraduate examination, a year of rotating compulsory house surgeoncy and another year of Junior House Surgeoncy of which six months are spent in general surgery.

Time spent in various posting

Of these three years, one year and six months are spent in general surgery (including urology and plastic reconstructive surgery, paediatric surgery and other allied specialities). Six months are

spent in orthopaedics including physical medicine, rehabilitation, hand and foot surgery. One year is allotted for specialities, three months each in anatomy, pathology, neurosurgery and thoracic surgery. A candidate may choose anaesthesia or E.N.T. if he has already done one of the specialities before.

The first two years of this period are spent as senior house surgeon and the last year as registrar. The responsibilities gradually increase and the registrar is fully responsible for the work and management of the unit.

Teaching

These candidates are allowed to teach undergraduate students. Students are posted to each one of them. Physical signs are taught to the undergraduate studeut in the outpatients. In trying to teach these undergraduates and answering their questions, the postgraduate benefits a lot.

Operative Surgery

These candidates are trained gradually under expert supervision, so that by the time they are registrars they should be confident of doing major surgical work by themselves.

Clinical Research

These candidates are encouraged to take part in clinical research and presentation of papert under guidance in conferences.

Postgraduate Lectures

We have a lecture once a week (Tuesday 8-30 p.m.). All staff members as well as the trainees take part in the programme. The programme is so constituted that the whole subject is covered in five years (150 lectures in all).

Postgraduate Clinical Examination

Once a week (Friday 5-00 p.m.), we have been having a clinical examination for the trainees. This usually consists of two "Long Cases" and a few "Short Cases." Each unit takes itsturn in conducting these including all the surgical speciality units.

Postgraduate Clinical Meeting

Once a week (Thursday 5-00 p.m.), we have a clinical meeting. Interesting cases from various units are brought in and discussed. Postgraduates are encouraged to take part in these discussions.

Journal Clubs

Every unit runs its own Journal Club. Once a week a member of the unit presents the interesting articles in the journal allotted to him.

Pathology Conferences

Once a week (Monday 4-00 p.m.) we have a joint conference with pathologists. This sometimes takes the form of clinico-pathological conferences.

Pathology Slide Conference

Every unit meets the pathology department once a week to review the specimens and slides of the previous week. This is very useful. It keeps us in touch with the histological appearances.

Undergraduate Ward Rounds

Postgraduates are encouraged to take part in these.

Statistical Conferences

Once a month this takes place where causes of death are discussed. This helps in improving surgical technique as well as pre- and post-operative care.

Unit Teaching Rounds

Once a week a unit teaching round is held. When there is free discussion at a postgraduate level, questions are asked and answered.

I have tried to give above some of the salient features of the postgraduate training programme as it is being practised today in Vellore. We are firm believers in the Resident "in service" programme which makes a trainee a good surgeon at the completion of his training in addition to preparing him for his examination. I have no hesitation in recommending this for your consideration.

TEACHING OF PATHOLOGY AND BASIC SCIENCES TO POSTGRADUATES IN SURGERY

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WE have come to this meeting to broaden our interest in, and knowledge of, postgraduate education as required today in our country. We cannot do this by attending pathologists' or surgeons' meetings alone. We pathologists must also know the point of view of the surgeons. I present the pathologists' point of view.

Some pathologists may insist that pathology is a science which is incapable of sub-division. We may say that it is capable of sub-division, one for medicine and one for surgery. In fact, it has been found just as necessary to specialize in the practice of various branches of pathology as it has been to specialize in the various sub-divisions of medicine and surgery.

The term "surgical pathology" then applies equally to gynaecological, ophthalmological and others in that category. It is the pragmatic application of pathology to the interpretation of disease during its early and curable states. It is not necessarily an exact approach, since the examination is only partial and not as complete as at an autopsy, but, for all that, it is an art, just as the practice of medicine is an art. However, the treatment of the patient depends upon the interpretation of it offered by the pathologist and this requires much experience and knowledge to be really fruitful.

Surgery has made tremendous progress in the world in the last thirty years, thus making possible a medical attack on many organs and diseases which were formerly beyond the reach of surgical approach. Tremendous strides have been made by surgery in this country also. Thus, the need for an individual, trained in disciplines of both clinical medicine and pathological anatomy, has become even more apparent. This individual must have a broad knowledge of many things, clinical as well as pathological. He not only must interpret the nature of the process, often from a small biopsy or a few cells in smears, but must be prepared to advise the surgeons or physicians as to what further line of action may be necessary in the case.

There has been a vast increase in the professional as well as the layman's interest in tumours in this country. The government has also shown interest in the control of cancer by opening cancer clinics and cancer detecting centres in many States Interest in tumour diagnosis and treatment in this country has been evidenced by the formation of Indian Cancer Society recently. In India, surgical pathology still requires proper organisation in many of our institutions of the desired standard. It must come out of an inconspicuous position as at present to its own as in other parts of the world.

Our aim and object of teaching pathology to the postgraduates in surgery should, therefore, be clear. The aim should be optimum teaching and training in surgical pathology. This can be achieved if the teaching and training material is optimum. This will require joint

efforts by the major departments of surgery and pathology in all the institutions of our country. It will be a novel idea also to procure teaching material from other parts of this country on a mutual exchange basis to make good the deficiency in any institution. Some institutions in India no doubt are richer in teaching material since they have more autopsies and operated material at their disposal.

The next question now arises, as to who should teach pathology to these postgraduates in surgery. At present, whatever little is done, is done by the department of surgery with the help of mounted specimens or slides borrowed from the department of pathology in most places. I do not think that this programme is adequate or is being aimed at now. It may be true that some larger institutions have made considerable progress in organising postgraduate teaching of pathology in individual clinical departments ,but no period is assigned to their postgraduates for exclusive training in pathology as full participants in the department of pathology. This clearly shows that there is a great disparity in postgraduate education in different parts of this country. There is still a great scope and need in this country for organising postgraduate education uniformly.

The old ideas must be shed and a new dynamic approach should be made for teaching pathology to the postgraduates in surgery. Until this is done, progress in surgery in this country will not be complete. I feel that surgeons, gynaecologists, ophthalmologists and other specialists should not undertake teaching of pathology to their postgraduates. I suggest this because while they have considerable familiarity with the pathology of their speciality they lack knowledge of general pathology even though I accept that they do have intimate knowledge of clinical and pathological aspects of their special diseases. They are also professionally very busy.

SCHEME OF TEACHING

If the future of postgraduate education is to be safeguarded in this country, the training has to be objective and practical. A few didactic lectures, seminars, and clinico-pathological conferences only will not solve this problem. Our present resources should be organised. We lack the teaching material in many institutions because there is a great dearth of autopsies. An autopsy is an operation after death which is free from pain and is for the benefit of all. It is an excellent teaching material. Most of the institutions lack a well organised photography department. In fact such a department should be a part of the laboratory of the department of pathology. Its duty should be to prepare teaching material for undergraduates and postgraduates. Duplicate material should be available to various clinical departments for day-to-day teaching. A well organised frozen section service and a cytology laboratory should be available for diagnosis and teaching.

All postgraduates in surgery should be called upon to do six months of compulsory residency in pathology before they are allowed to take up their postgraduate examination in surgery. In fact, this should be applied to all the clinical subjects, since I am convinced that the teaching of the clinical subjects is not complete at the postgraduate level without a minimum period of whole-time training in pathology. This would give a practice in scientific approach towards the diagnosis of the disease process. I, therefore, feel that the training in surgical pathology

should be entrusted to the department of pathology, by completely assigning the postgraduates for six months in pathology. Training should be, therefore, continuous and not in parts. It should be complete and not selective. He should be a full participant in all the training programmes with the postgraduates in pathology. The training scheme should also include training in clinical pathology, chemical pathology and microbiology.

TEACHING AND TRAINING PROGRAMME

The programme should begin with the morning signout of surgicals which have already been described, cut, and were kept ready for reporting the evening before. The postgraduates must see all slides in the evening and prepare themselves for the productive discussion after writing their diagnosis and opinion. These slides will be checked at the time of final reporting by staff members. This will train them to use such knowledge to intepret the disease process.

The next part in the daily routine is the gross pathology of the surgical specimen, received from all specialities, which must be described objectively and necessary blocks be given for routine staining keeping in view special stains to be ordered in arriving at final diagnosis.

This will give chance to the postgraduates to see disease process on the bodywise basis rather than limiting them to their own speciality. They will thus learn the basic facts in pathology and will have sound concepts of pathology.

There should be a weekly surgico-pathological conference in which all the diagnosed surgicals along with their gross must be presented by the department to the staff of surgery, obstetrics, gynaecology, ophthalmology and radiology. The unit-in-charge of the case should present all the clinical information together with the operative notes, and radiologist will show the films and discuss the radiological diagnosis. The pathologist would present the pathologic material. This will really stimulate thinking in the postgraduates and will give them a chance to participate in discussion.

There is also a need of more training, specially in tumour diagnosis. The seminar on tumour should be organised every two months and conducted by the departments of pathology and surgery. This should be a well organised joint effort.

Training in pathological anatomy based upon the autopsy is the foundation on which all knowledge rests. The postgraduate, therefore, should be put on duty on the autopsy service and should write up some autopsies An autopsy done and demonstrated is a complete chapter in itself. It produces a remarkable impression on both undergraduate and postgraduate students. All should gather in the auditorium and study the autopsies keeping in mind the adage "gladly we teach and gladly we learn." In each institution at the annual staff conference figures should be published for the number of post-mortems procured by each department. This will be an excellent teaching material for the postgraduates in surgery assigned to pathology department and also to those who go back to surgery after their assignment, i.e. after they have completed their six months of residency in pathology. This is another example where joint efforts of both the departments can bear fruitful results in achieving our aim.

Another phase of training is the rapid diagnosis of lesions during operation by the method of frozen section. Operation theatres must always send to the department of pathology one

day in advance as a routine the list of the scheduled operations giving the names of operating surgeons, time, and the name of the operation. This list must also mention if a frozen section is required giving the time at which the material will be available. This will give a chance to the postgraduates to learn pathology during operation. This will also be a proper step toward giving an excellent pathology service to the patient and provide an opportunity to co-ordinate the efforts of the departments of pathology and surgery.

There should also be monthly slide conferences of the teaching material of rare diagnostic problems, arranged systemwise. These teaching sets may be prepared by mutual exchange from other institutions also. These should include clinical histories, operative notes, gross description, and X-ray films. Working classifications of diseases may be discussed to stimulate interest in geographical pathology also.

TEACHING IN OTHER BASIC SCIENCES

I consider that the major effort in the curriculum should be made to teach surgical and autopsy pathology, but basic sciences should also be taught. The basic sciences to be included in the curriculum from the point of view of applied aspects should be physiology and biochemistry. Emphasis should be on the application of physiological and biochemical techniques which should be correlated with pathological anatomy to study disease processes. This can be achieved by assigning to them the patients admitted in surgical wards for carrying out independent laboratory investigations in the laboratories of chemical pathology, clinical pathology, and microbiology during their six months' assignments in the pathology department. This will afford the postgraduates an opportunity to carry out investigations on their patients. They will thus learn the application and interpretation in the study of disease process. This they will present in the meeting of the staff in weekly surgico-pathological conferences. They should also participate in the discussions.

The postgraduate should also know that these laboratory tests, if performed at random, and not too well, are of little use in arriving at a diagnosis. Pathologists, therefore, have a natural role as integrators of diagnostic data.

He should also be the participant in Blood Bank service and transfusion techniques during his assignment of six months.

In conclusion, I emphasise that a joint effort should be made by surgeons and pathologists to develop postgraduate teaching, if the postgraduate education has to succeed in a real sense in our country. Training and teaching should continue for a period of at least six months. It is a valuable training for a surgeon to serve a term in the laboratory, because his ability to distinguish pathologic from non-pathologic conditions encountered in future surgical practice will depend largely upon this training. It will prepare him to be a good surgeon.

THESIS OR DISSERTATION AS PREREQUISITE FOR POSTGRADUATE EXAMINATION

PROF. A. K. BASU

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THE importance of research work as an essential part of postgraduate medical education has been emphasized on many platforms on numerous occasions. Medical research is developing at an ever-widening pace on numerous frontiers. There have been more advances in medical knowledge in the last 25 years than probably in all the preceding years since the days of Hippocrates or Sushruta. Many or even most of these discoveries have been made by young men in the formative years of their medical education and some even in their undergraduate days—witness for example the discovery of pancreatic islets by Langerhans and of Insulin by Best. Frossman was a young postgraduate when he hit on the idea of introducing catheters in the heart and Hunter, the Australian anatomist, described the benefits of sympathectomy while still in his twenties. Numerous other examples may be given but it is enough to say that it is in the young mind, unshackled by time-worn old shibboleths, ever free to strike out new paths, ever receptive to newer ideas and thoughts, that the benefits and the methodology of research should be firmly ingrained.

Unfortunately, we in India, until recently, had failed completely in understanding and accepting the value of research work in postgraduate medical education. We were content to imbibe ideas from abroad and hardly produced any of our own. The bureaucratic system of medical administration in this country, in addition, left little scope and fewer opportunities to do research or any original work.

In many Indian universities today, one of the prerequisites to be eligible for the higher postgraduate examination is the preparation of a thesis embodying research or investigative work of some kind. However, the standard required or expected varies markedly from one university to another. A few of the universities require the candidate to do the work himself and to show that the work has in some way "advanced the frontier of medical knowledge." Other universities would accept what they call a dissertation, meaning thereby a collection of views and opinions of others embellished perhaps by a few notes or data which one again obtained from others. It seems that there has been no rational and cogent rethinking on this problem and the benefits of the process have not been deliberated at length.

OBJECTIVES

What are the objectives of this plan of research activity and the writing of the theses on the part of a postgraduate student working for his degree. I am sure that the idea is not so much that every student would be able to contribute a vastly superior fund of knowledge to his subject but that he would show evidence of grappling with a particular problem in a systematized

way and having at least contributed some thought to the elucidation of the problem. The plan postulates that the postgraduate student should have an enquiring mind, that he should be able to assess and reject, if necessary, the seemingly established thoughts on current ideas and be prepared to carve out new paths on old time-worn field. The basic idea is to inculcate in the mind of the trainee that the last word has never been said about any medical knowledge, that what passes for knowledge is often based on most slippery foundations and that the printed word has no more sanctity than the paper on which it is printed. It is expected that out of this band of numerous budding research workers on the threshold of their postgraduate careers will emerge at least a few who will accept this kind of work as their life-long avocation and thereby enrich the research potential of the country.

ADVANTAGES

If the students and trainees are considered as the backbone of a postgraduate department, the advantages and benefits of research-oriented training programmes are very obvious. In the first place, they bring to the department an atmosphere of learning, of serious study and of a spirit of enquiry without which an academic department must be considered sterile and lustreless. Such an atmosphere is conducive to the best interests of both the teacher and the student. If the teacher is worth his salt, he must act not only as the guide of the student but also as his philosopher and friend. Opportunities to know the student well and to be familiar with his problems come up automatically in this programme and the student-teacher relationship is, therefore, firmly based on mutual comprehension and understanding.

The benefits of the research-orientated study programme to the student himself are immense and many-sided. Instead of merely attempting to learn the facts as they are, it gives him opportunity and satisfaction of trying to contribute to new knowledge, however meagre that may be. It makes him familiar with methods of studying existing literature on the subjects, summarizing or abstracting such literature and making use of it in the context of his own programme. Instead of merely going over the usual text-books, the student has the opportunity of rummaging over the vast field of world literature on the subject of his choice and to discover for himself the world-wide mode of thinking on the problem. Most of all, this method of study takes the student off the beaten track, makes him think, thus increasing and improving his faculties of imagination and reasoning. On the whole, it makes him a better scientific man.

work takes precedence over an adequate training programme and as a trainee the student is no better at the end of the stipulated training period than he was at the beginning.

WHAT SHOULD BE DONE

What then are we to make of or decide about this kind of study programme in the context of our national needs? We have to bear two things in mind. First, the country needs a large number of specialists well trained and well versed in postgraduate study in as short a period as possible. Promptitude and avoidance of useless and unfruitful waste of time should, therefore, be the keynote of our training programme. Emphasis should be placed on acquiring the essential knowledge, learning the important technique and developing judgment, confidence and independence in the performance of the allotted work.

At the same time, one need not be blind to developing the inquiring incentives in the minds of our young specialists. It is essential that while we are imparting practical knowledge to our young postgraduates, we should also try and stimulate the desire to prosecute original work which lies dormant in the minds of most aspiring medicos. However, the subject of research study must be chosen with a good deal of care. It should take up specific, well defined problems. It should be capable of solution in one way or another within the limitations of the facilities available at the particular institute. It should not involve wastage of too much time at the disposal of the postgraduate and certainly not be done at the expense of his overall training programme. It should be carefully supervised at every stage—the temptation to take up side issues not relevant to the problem under study should be scrupulously avoided.

SUMMARY AND CONCLUSION

In summary, therefore, it appears to me that although there are many arguments against introducing or retaining a programme of research study in the postgraduate training period, the balance of evidence seems to be in favour of such or research-orientated programme. The life of a postgraduate with this programme is made more interesting, more enjoyable and a keen student finds it a rewarding endeavour. His future progress to academic hierarchy is built on surer grounds and many future successful research workers will have looked back on this formative period of their work with wistfulness and affectionate remembrance. Here was time well spent in learning the methodology and techniques of research, they would say.

However, this kind of research activity in a medical scientist must be supervised with caution and it must form an important but not necessarily the most essential part of his overall training programme as a specialist. But it must not prevent him from learning the basic essentials of his subject nor in his mastering of the practical aspects of his speciality.

The research-orientated study programme is intended to make the postgraduate a scientific man and it should prevent him from being only a technician or a craftsman.

METHODS OF ASSESSMENT

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THE postgraduate training in many fields including surgery takes many years of continuous hard work and training under properly selected surgical teams in a teaching hospital. As this entails long years of study and work in addition to the expense on the part of the candidate or the State, it is extremely important that we should have a clear concept about the methods of assessment and the selectino of the candidates for this purpose. This assessment will have to be made throughout the period of the candidate's training and the record of progress of the candidate should be available to the authorities concerned quarterly in a year. This will be useful from the poiot of view of knowiog whether a candidate should be permitted to continue his work or should be ioformed that in his own interest it would be better if he leaves the institution where he is being trained and pursue some other course of action. Such a decisioo would avoid disappointmeot to the candidate later on and would save enormous expense to him or to the public exchequer. Further, it is being realised that postgraduate training has to be carried on for several years and the cost of such a training should primarily be borne by the State as it is extremely difficult, with the risiog cost of living, for aoy person to afford it from his owo resources. This fact has been recognised by the Goveroment of India in the field of technical education and hence every candidate who is pursuing postgraduate training io the National Iostitutes of Technology is getting a scholarship of Rs. 300 per mensem. Similar facilities are provided in many of the universities for training for Ph.D. In view of these facts, it is extremely important that we should develop methods to: (*i*) assess the candidate at the time of the admission for such a training, and (*ii*) assess the candidate during the period of his traioing.

ASSESSMENT BEFORE ADMISSION

1. *Interview:* The interview of the candidate should be conducted by the senior members of the staff of the department in which the candidate has to undergo his training. This should be for a period of at least one hour during which the academic record of the candidate during his undergraduate career should be carefully ascertained. A personal discussion with the candidate should bring out why he is interested in taking up a given speciality and searching questions could be asked to gauge his powers of deduction and general intelligence. Due emphasis should be laid on the personality and the sports and other extra-curricular activities io which the candidate has been taking part during his undergraduate career.

2. *Screening examination:* A clinical and practical screening examination should be carried out in the case of every prospective candidate in order to know if he has sound

foundations of basic and clinical medical sciences. It is well recognised that without such a foundation it would be extremely difficult to build the superstructure of postgraduate medical training.

3. It would be desirable if the candidate can stay for three to four days on the campus of the Institute so that he has a chance to meet other members of the staff who would thereby have ample opportunity to actually assess him during this period.

4. Confidential report from the headmaster of the school and the principals of the medical college and the science college in which he has studied should be obtained in every case for final assessment.

ASSESSMENT AFTER ADMISSION TO THE POSTGRADUATE COURSE

1. Every candidate, on admission, should be assigned to a supervisor who should be of not less than the rank of an Assistant Professor in that institute. This supervisor should be his guide, philosopher and friend and should look after him for the next three years of his training in that institute. It would be the supervisor's duty not only to assess him throughout this period but also to give him help and guidance from time to time both in his academic work and in sorting out his personal, social or financial problems. Such a course has paid very rich dividends in the older universities at Oxford and Cambridge. Further, such an arrangement would build up bonds of friendship between the candidates and the senior teachers of the Institute.

2. Monthly reports should be obtained from all the teachers under whom the candidate has to work in the outpatient and the inpatient departments. The work and progress of the candidate would be judged in his clinical teaching as well in the seminars and tutorials by these teachers.

3. The supervisors of the thesis should send a periodic report about the progress of the candidate who is working under his care.

4. Periodic reports should also be obtained from the departments of basic medical sciences and experimental medicine about the quality of the work of the candidate in these departments.

5. Periodic oral and practical examinations should be carried out from time to time by the senior teachers.

6. A written and oral examination should be conducted three months before the candidate has to appear in his university examination in order to assess as to whether the candidate has benefited from his training and is now ready to appear in the university examination.

7. The senior teachers should send a six-monthly report about their assessment of the students with regard to participation in the clinico-pathological conferences, their work in the operation theatre and their capacity for teaching.

8. Reports could also be obtained from senior members of other departments about their impressions of the student regarding his conduct and behaviour in the hospital, laboratories and on the playgrounds.

CONCLUSIONS

It is extremely important that the candidate should be selected with the greatest amount of care and that he should be constantly assessed during the period of his training. In assessing the candidate periodically, great importance should be attached to his work in the wards and the outpatient departments, his method of conducting research in the department of experimental medicine and his capacity for leadership and his demeanour and behaviour in the institution both during his academic work and on the playgrounds. The day-to-day assessment of the candidate carried out by the tutors and the supervisors should play an important role in the final assessment of the candidate for his success in the higher examinations. Devotion to work and welfare of the patient, high sense of integrity, qualities of leadership and proficiency in sports and extracurricular activities should be the hall-mark of a well-trained specialist.

REPORT OF THE SUB-COMMITTEE ON GENERAL SURGERY

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A teaching institution should fulfil the basic requirements laid down by the All-India Medical Council regarding staff and equipment before starting the postgraduate course in general surgery. The institution should also possess an efficient recording system and record library.

The criterion for selection to this course should be that a candidate has passed the pre-clinical and undergraduate examinations with merit, and he should be selected at the interview by a committee consisting of the members of the department of surgery, the clinical faculties, the head of the institution and, if possible, a representative of the university. There should be a further assessment after one year at the end of the house-surgeoncy.

The course should be an in-service training programme for four years after full registration.

(*a*) The first six months should be spent as house-surgeon in the department of general surgery in a recognised hospital which need not be a teaching hospital. Such a non-teaching hospital should be classified by an Association of Hospitals as an 'A' class hospital. An Association of Hospitals similar to that in the U.S. should be established with the help of the Government.

(*b*) The next six months should be spent as elective rotating house-surgeon.

(*c*) Three years should be spent as registrar, two years being in the department of surgery. For the first six months of these two years the candidate should devote his afternoons to the study of basic sciences, such as pathology, anatomy, physiology and biochemistry, while the afternoons of the next six months should be spent in learning techniques in experimental surgery.

(*d*) The fourth year should be devoted to other specialities of surgery, such as orthopaedics, urology, thoracic, plastic and paediatric surgery. During the three years as registrar, the candidate should be given increasing responsibility in clinical and operative surgery so that at the end of four years be attains knowledge and skill as a surgeon. The curriculum should be flexible and not rigid. During the in-service training, postgraduates should be given adequate remuneration and good living quarters. A large number of posts should be created to accommodate the postgraduates as part of the organisation. This problem could be partly solved by deputing them in their first six months to other hospitals and also by appointing them as junior demonstrators in the departments of basic sciences during their period of study there.

A candidate should submit a dissertation which should be an exposition of a problem he has studied under the guidance of a teacher. The dissertation should indicate the methodology

involved in the collectioo aod rearrangement of data and a critical analysis of the literature aod the candidate's own work.

There should he continuous assessmeot of the candidate. Fifty per ceot of the total marks should be for day-to-day assessmeot, ten per cent to be earmarked for the dissertation and the remaioing forty per cent for the fioal examination which should he writteo and practical with emphasis on the latter. Examinations should be patterned oo the Royal College examioatioos in the Uoited Kingdom. Examinations should he cooducted by a oatiooal organisatioo to achieve uoiformity of standard.

A candidate should be allowed to appear for the postgraduate examioatioo several years after graduatioo even though he may oot have fulfilled all the conditioos, because he may become mature in judgement later and his taleot otherwise go unrecognized.

POSTGRADUATE EDUCATION IN OBSTETRICS AND GYNAECOLOGY

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IN India today there is an upsurge of interest in postgraduate medical education. Its importance is widely recognised and there is a growing awareness of existing deficiencies. A large number of medical colleges have sprung up in the country due to the rapid expansion of undergraduate medical education to meet the country's shortage of doctors. There is a great dearth of qualified and experienced teachers to man these institutions with the result that standards suffer. And when under such circumstances the newly started institutions embark on postgraduate education also, it becomes evident that marked deficiencies are bound to be manifest in the facilities, training and standards. The aim of this panel should be to scrutinise critically the existing pattern of postgraduate education in our speciality, assess these deficiencies and put forth suggestions to improve the education.

SCOPE AND PURPOSE OF POSTGRADUATE EDUCATION

Postgraduate education begins after a person has obtained his full registration and in a sense should continue to the end of his professional career. This education is only an expansion and extension of undergraduate education, a process that could and should continue throughout the life of a doctor. It should take into consideration the country's needs and make available by such education a satisfactory standard of medical care to the community. The postgraduate education scheme should, therefore, have the following objectives: (1) the training of personnel to become teachers and research workers for academic institutions, (2) of specialists for service in non-teaching hospitals and in the country at large, and (3) education of general practitioners by refresher courses in the speciality.

The scope of training should, therefore, be broad-based and of a good standard, the method and type of training being determined by the aim, namely, to have a good clinical specialist for in-service hospitals or for the education of a general practitioner.

THE PRESENT POSITION

There is no doubt that postgraduate medical education has become a burning problem. Medical colleges are being opened in large numbers but there is a great dearth of qualified teachers to man these institutions. Therefore, there is a great rush to obtain a postgraduate degree in the speciality of one's choice, and, may I say also, a sad tendency to lower the standards to meet the increasing demands. In general, all our universities have almost the same

pre-requisites essential for entering the postgraduate courses and taking the examination—, namely, one year of house surgeoncy in medicine and surgery after full registration followed by two academic years of training in the speciality under a recognised professor in a recognised institution. In some universities, like Madras, the diploma in obstetrics and gynaecology which can be taken after one year of training subsequent to a year of general house surgeoncy is a pre-requisite before a candidate can be admitted for the higher training. We cannot but admit that there are wide variations in the type of training and, what is more, also in the standards of examination.

It has not been possible to obtain all the data from different institutions undertaking postgraduate training. From what I could gather from my discussions with the students and professors of various universities, the majority would agree with me if I state that at present organised, planned and purposeful training is unfortunately very rare. Two types of students undergo postgraduate training after registration for the postgraduate degree—whole-time students and part-time students who are medical officers on the staff of the hospital. In the majority of institutions, postgraduates are not residents and what is more it is not uncommon for a postgraduate student to register for the degree and to do his own private practice helping his chief also in the latter's private clinic. The numbers selected for training vary widely. There does not seem to be any general policy regarding the number of students to be taken for training by any one professor at a time. Each institution has its own standards of selecting the number of students and even in the qualifications laid down for recognition as a postgraduate professor there is hardly any uniformity. It is unfortunate that this is so. Now, if there is no organised and purposeful training programme, it is to a large extent due to the lack of standards. Further, faculties for postgraduate training must be available before an institution can undertake postgraduate training. This necessarily means close association and co-operation of all the basic and ancillary departments without which no postgraduate training will be worth undertaking. Unfortunately, under existing conditions, this is sadly lacking and hence the training of a postgraduate is mainly clinical with a view to obtaining a degree. In general, students are given opportunities for clinical work under the guidance of their teachers. The actual quantum of practical training, namely, training in operative obstetrics and gynaecology, varies with institutions and in many, I must confess from what I have learnt in my informal talks with students, such training leaves much to be desired. Often the quantum of practical training is negligible. Collaboration with other departments—pathology, biochemistry, physiology etc.—is scanty. There are a certain number of lectures delivered to students in certain institutions, while in others these are in a seminar form, and there are some with neither.

In almost all the universities the students, before they appear for the examination, have to submit a paper which goes under such names as thesis, dissertation, commentary, case records. They are supposed to have done these themselves and it is not uncommon to find that what is called a thesis is just an analysis of a few case sheets culled from the records room and analysed quoting the relevant literature verbatim. The books so submitted are well bound and very often of remarkable size and are quite attractive with photographs borrowed from various standard publications. I do not wish to talk in more detail about the system of training

that is prevalent but enough has been said to conclude that the training as it is in general is ill-conceived, not purposeful or broad-based, and is on the whole unsatisfactory.

Then there are the examinations. In all universities there is, in addition to the speciality papers, a paper in general medicine also, and in some universities, an examination in clinical medicine also. There are the clinical and viva-voce examinations in the speciality. That the standards of examination vary is well known. It is also well known that failure and success rates vary widely in the different universities. More about this later. I have briefly, with what information I have, tried to present the situation in postgraduate training in our speciality that is prevalent today.

It is an oft-quoted saying that everybody knows more about obstetrics and gynaecology than the obstetrician and gynaecologist himself. Many new ideas and changes have taken place in our speciality. The physician, endocrinologist, pediatrician, genito-urinary and plastic surgeons, psychiatrist, anaesthetist, radiologist all claim to be more qualified than the obstetrician and gynaecologist to deal with the problems facing us. It is indeed strange that such aggression—benevolent no doubt—should have taken place in our speciality. We have to pause and ponder why it is so and if we are to survive as a speciality we have to educate and train our postgraduates in such a way that they would get a basic training in all these disciplines which have made inroads into our speciality.

That is to say we have to reorientate the training of the future specialists in obstetrics and gynaecology. In addition to the usual dose of anatomy, physiology, biochemistry and pathology a student should have—to mention a few—a basic knowledge of radiation and current views on it, physiology of the newborn infant in general, placental transmission, biochemistry of hormones and now, of course, the chromosomes. In any good training programme, these studies should be incorporated so that the clinical and practical aspects of the training may rest on sound basic principles. Then only can we consider the training as broad-based and purposeful. The impact of developments in basic sciences and allied disciplines has been such that we cannot ignore it in the training of our future specialists.

If it is agreed that these subjects should form an integral part of the education and training of a specialist, the next question is what is the minimum period required for such training. While I am averse to recommending any unnecessary increase in the years of training before a specialist can be turned out, I am fully conscious of the inadequacy of a two-year training period. Three years in my opinion is the minimum period required.

What I have stated above is the standard that should be laid down for the future specialists who are to man our teaching and research departments. But we have to consider the very large number of specialists required for service in the country other than teachers in the hospitals. I am visualising the time when at least all the major non-teaching hospitals in the country will have on their staff specialists in obstetrics and gynaecology. Should these specialists also undergo the same three-year training which is really meant for an academic career? While it would be desirable, it would not be easily possible for some time to staff all our hospitals with such specialists. What is required in the non-teaching hospitals is a specialist with a high standard of clinical and practical excellence. In other words, would it not be worth

while to take up those who are interested in the speciality, give them training in teaching in hospitals essentially on clinical and practical lines for a couple of years and then make them suitable to serve as specialists in non-teaching hospitals?

THE TRAINING PROGRAMMES

I have already pointed out that the training of our specialists is at present essentially clinical and at best defective even at that. In any country, the training should take into consideration the needs of the country and consequently its socio-economic implications. As it is now, we have to train specialists for an academic career and a much larger number for service to the country and community at large. In the training of the former, there should be a happy blending of the basic sciences, the allied disciplines referred to already and the clinical and practical aspects of the speciality. For the specialists to serve the community at large the emphasis in training should be on the clinical and practical aspects with inclusion of the minimum necessary information on basic and allied disciplines. This would mean that a department before it can be encouraged to undertake postgraduate training in the speciality should have not only its own speciality well developed but also all the ancillary departments. These departments must whole-heartedly cooperate in the training of our specialists.

It is not possible nor desirable to chalk out a detailed training programme. Such details should be worked out by each departmental head depending on facilities. But certain suggestions could be made. For proper training it is essential that all postgraduate trainees be resident and working whole-time under professors who should also be whole-time employees of the institution. No postgraduate professor should have under him more than 2-3 postgraduates at a time and where there is more than one postgraduate professor in an institution it would be useful for the students to work under the different professors for varying lengths of time. Thus they would be exposed to different lines of thought, skills and achievements instead of stagnating under one person. It gives the student an opportunity to see the different types of work, assess for himself the value and standard of such work and decide for himself what is good and what is bad. Guidance should always be available at the highest level, whether it be in the clinical or academic aspect of the training. Academic lectures on set subjects, except perhaps in those on which the professor himself has done some original work, are usually not worthy of encouragement. It is far better to organise student seminars and seminars by the senior staff in which members of the various disciplines take part. Ward rounds and bedside clinics and clinical demonstrations with all investigatory data should form an essential part of the training as also practical training in abnormal obstetrics and operative gynaecology. Postgraduates should be encouraged to spend a few hours a week in the departments of pathology, biochemistry, radiology and radio-therapy and other ancillary departments. I have often felt that informal teaching and discussions pay better dividends than formal teaching. Audio-visual aids are a necessity.

For postgraduate education there is no syllabus. The training should be broad-based and comprehensive and, what is more important, it should stimulate the student to think for himself and help him to take initiative. Encouragement and fostering of scientific attitudes in the approach to problems and patients is an utter necessity and must be one of the important aims

in training. A postgraduate professor should be deemed a failure if he cannot stimulate his students to think and work out on their own initiative solutions to problems facing them. Good library facilities and guidance must be available at all times.

RESEARCH

It should be the aim of every training centre to stimulate the students to research work. Research is of two kinds, fundamental and clinical. Fundamental research is of supreme importance but unfortunately not many are gifted and equipped for such research. Equally important is the clinical research. This is a type of work which every member of the teaching staff could and should undertake and is very important not only from the point of view of teaching and training but also from that of the patients. For such research there is immense scope in our country. Facilities for fundamental research are being built up in our institutions. I am visualising the time when each department will have a research professor with a well-equipped laboratory and technical staff to work in close collaboration with the clinical professors. Such a situation will further stimulate the young postgraduate and help to bring forth his own initiative. The professor in charge of postgraduate training should be permitted to pick out the promising ones for further training in research so that he can have ultimately a number of such trained persons to distribute all over the country. Such encouragements to our young men will pay high dividends and if in academic appointments merit be the only consideration, which at present it is not, the future of our institutions and standards of medical education will be improved and preserved.

This raises the question as to what amount of research should be done by a student during his training. Under the existing two-year-period programme of training with an examination at the end which is essentially clinical and practical, it is not fair to expect a candidate to do original research work and submit a thesis as part fulfilment of the examination. He could be encouraged to work on a small problem clinical or otherwise, and be asked to submit an analysis of his work. But if the course is extended to cover a continuous period of three years, then a student could be expected to do some basic, applied or experimental work provided there are facilities and guidance available. Many universities require students to submit either case records with commentaries, dissertations or theses. A fair number of the so-called theses or dissertations is, in my opinion, just a heap of statistical data culled out from records with the literature on the subject incorporated verbatim. If examiners have been accepting them, it is mainly because they have realised the limitations imposed by time, lack of facilities, and guidance available to the student.

And, finally, there is the examination which consists of written, clinical and *viva voce*. At present these examinations are a necessary evil as there is no other method of assessment. The standards vary from university to university. It is very unfortunate that it is so and it is high time that a certain degree of standardisation is achieved.

The examination should be broad-based and should test the candidate's knowledge of basic things. The degree he would acquire after passing it does not make him a specialist or a professor straightway. It only denotes that the foundation has been laid for building a

good superstructure and hence the aim of the examination should be to test whether such a foundation has been built or not.

There is a large incidence of failure in the postgraduate examinations. Various factors contribute to it—the type of candidate selected for training, the facilities and machinery for training, the teacher and his training programme. Whether we like it or not we have to realise not all students are suited for specialisation and that selection is not entirely on merit. Improvements in selection and training are very necessary if we are to attain better results. There is a general tendency to take in a large number of candidates for training as the country requires a large number of specialists. Such large numbers if taken in especially when facilities are meagre necessarily means very inadequate training, lowered standards and poor results in examination. It would be a sad day for the country if our teaching institutions are to be staffed with inadequately trained, substandard specialists.

It is necessary to emphasise that medical education is a continuing process. Unfortunately, there is a sad tendency to take things easy after a postgraduate qualification is obtained and an appointment on the teaching staff confirmed. Such a tendency is detrimental to further progress and in a teacher it is inexcusable.

All postgraduate training centres should consider it their duty to hold refresher courses for the general practitioners. Obstetrics and gynaecology are still dealt with by a large number of general practitioners and if the community at large is to benefit it is necessary that these doctors also attend periodic refresher courses at the nearest postgraduate centre. Then only the standard of service they can offer to the community will improve.

METHODS OF TRAINING

Dr. P. K. Devi

THE object of postgraduate training in clinical sciences is not only to impart advanced instruction in the speciality concerned, but also to create in the student a "scientific" attitude of mind and ability to continue his education. In addition, the basic principles underlying the various technical procedures must be grasped and a reasonable amount of skill in carrying out certain standard procedures must be acquired. In the field of obstetrics, specially, the teacher has always to keep in mind that he must not only aim at creating an able craftsman, but in addition must produce a keen and alert observer and a good clinician capable of taking intelligent and quick decisions. It is needless to emphasise that if these objectives are to be achieved in the short span of two academic years, the teacher and taught must put their very best into the training in a planned, organised manner and adequate facilities should be provided.

Each institution should be allowed a certain degree of freedom to choose or experiment with the methods of training if they so desire and not be bound down by any rigid regulations. Twenty-five years ago, postgraduate students in this country were left alone to study the subject and prepare themselves to be consultants. Many of the senior teachers in the profession today will remember that there were hardly any seminars or symposia or lectures for postgraduates in those days. From this extreme, the pendulum has swung today and we have a plethora of lectures, seminars, clinical conferences, journal clubs, etc., most of them, I am afraid, conducted in a dictatorial manner by senior teachers in the subjects.

The various methods in teaching are briefly discussed below, keeping in mind their scope and limitations.

1. **Introductory lectures:** It is well for the student to know what are the objectives of his training and what is his own part in it and this should be emphasised in one or two introductory sessions and briefly the plan or programme for each term discussed. The teacher should at all times emphasise that the course is meant to acquire knowledge (theoretical) and develop wisdom (application of theoretical knowledge to practical problems) rather than merely to pass an examination. The introductory session can include some of the topics like genetics, demography, organisation of maternity services, maintenance of records, principles of statistics, etc.

2. **Lectures:** Though didactic lectures should be kept to a minimum, yet these are necessary to emphasise basic principles and to present a clear bird's-eye-view of selected subjects. Lecture notes should preferably be distributed in advance, so that the attention of the students is not distracted in note-taking. Audiovisual aids should be used judiciously and the topics chosen each year according to the current progress in the subject.

3. **Journal Clubs:** The journal club is meant not merely to present summaries or reviews of important articles, but to bring forth a critical evaluation of important publications

by students or staff. All members of the staff of the department should take part in these and a list of papers to be reviewed should be put up in advance. At all times, the teacher must be careful to avoid an authoritarian attitude in these discussions, particularly if he is an examiner also.

4. Seminars and Symposia: The subjects should be carefully chosen and the choice should be influenced by advances in allied sciences and senior teachers from other specialities invited to take part. In this connection, obstetrics is unique in that it combines the essence from most other specialities (clinical and non-clinical, such as internal medicine, endocrinology, pediatrics, anaesthesiology, radiology, etc.), and it is impossible for one teacher to be conversant with current progress in all these fields. The students should participate in the discussions freely once the subjects have been introduced by the senior teachers.

5. Clinical or Practical training: It should include sessions on diagnosis and planning of treatment, discussions and demonstrations of diagnostic procedures and operative techniques, out-patient sessions, death conferences, emergency duties, and grand rounds. Periodic assessment of the progress of the student and the skill acquired by him is necessary. It is important to give graded responsibility to the student for patient care, planning and execution of treatment under adequate supervision, as otherwise the student tends to become merely a passive observer. The student must feel and must work as a member of the team and it may help if he keeps records and commentaries on cases he has observed or handled personally.

6. Integrated Teaching with Basic Sciences: Clinico-pathologic conferences, sessions on pathology, biochemistry, and anatomy in relation to the specialities of obstetrics and gynaecology, should be organised so that the student as well as the teacher does not remain confined below the brim of the pelvis. It is essential for the student even in the early days of his training to realise that advances in his speciality are closely linked with advances in related fields.

7. Periodic Assessment: The teacher should be responsible to assess the skill acquired by the student in clinical work as well as theory. Periodic written tests help the student to improve his style and expression, and train him in presenting his knowledge in an effective manner.

8. Visits by guest lecturers attending conferences, visits to other institutions, etc. are very helpful in rounding off the training of the student, but it is doubtful how far this can be fitted into the short span of two years of training.

9. Experimental research and teaching of undergraduates should not be included in the training of the postgraduates, unless the period of training is increased. Only a few postgraduate students in obstetrics have teaching or research as their objective, and within a very limited period of two academic years, it is better for the student to concentrate on training himself to be a good specialist or consultant. Throughout the course it would be ideal if the teacher can himself set an example as to what a good teacher ought to be and create in the student an attitude of mind oriented towards research rather than insist on actually carrying out any research. It would be worth while and stimulating to hold departmental and interdepartmental conferences once a term to discuss research projects which are being carried out in different departments.

The above methods, in my opinion, can be incorporated into methods of training in any clinical subject and in conclusion I should like to stress that teachers with vision and students with enthusiasm can make any kind of teaching programme a success.

TEACHING OF PATHOLOGY AND BASIC SCIENCES IN THE CURRICULUM

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THE provision of facilities for postgraduate training and education is more important now when our aim of undergraduate teaching is to prepare basic doctors. The science of medicine is progressing at such a pace that it is no longer possible for any individual to become familiar with every aspect of his profession. A broad comprehensive survey of modern medicine should, therefore, be of material assistance to every practitioner as well as to those with special training. With this object in view, there is a great need of organising a carefully planned course in basic medical sciences for postgraduates in various specialities. This course represents an effort to integrate the teaching of anatomy, physiology, biochemistry, pathology and bacteriology in a way as to bring home to the graduates who attend it the fundamental importance of a knowledge of scientific principles. It is intended to provide a solid foundation upon which the student subsequently builds for himself a superstructure of factual knowledge.

A six months' (24 weeks) course in which the postgraduates devote themselves wholetime to the learning of basic medical sciences is very much desirable. Each basic medical science department has to arrange seminars, lectures, demonstrations and even practicals to lay a good foundation for the future studies in the speciality of obstetrics and gynaecology. Six hours' teaching programme on all working days has to be organised with an average of at least 30 hours' teaching in a week; a total of 500-600 hours of teaching programme should be able to cover the essential topics of all the basic and allied medical sciences which could be distributed according to the scope for each subject in the following manner: anatomy 75 hours, physiology 35, biochemistry 40, pharmacology 35, pathology 100, and social and preventive medicine and others 15 hours.

The broad objectives of this course should be as follows:

1. To introduce the student to the literature, experimental methods and fundamental principles associated with each of the basic medical sciences.

2. Attempt has to be made to present the material in an integrated fashion in such a way that the course centres round the morphological and functional characteristics of organs.

3. To stress the thoroughness of approach to the topics selected rather than to attempt too wide a coverage.

4. To endeavour to inculcate in the student an ability to evaluate data critically and to present orally experimental results in a clear and concise manner.

The important topics to be covered in each basic medical science should be as noted below. These would be dealt with more in the form of seminars than as didactic lectures. A few symposia on such topics as could be dealt with by several departments should also be arranged.

ANATOMY

Lectures with demonstrations (50 hours) and practicals (25 hours) may be the minimum to cover important subjects for the postgraduates of this speciality. In the lectures and demonstrations the topics to be covered are general anatomy of the abdomen, regional anatomy of the abdominal organs, anatomy of female bony pelvis, anatomy of pelvic floor and perineal diaphragm, anatomy of female genital and genito-urinary organs, development of human embryo and common abnormalities of female genital organs, multiple pregnancies, elementary genetics, and micro-anatomy of female genital organs. In the practicals, the candidates should dissect the abdomen and female pelvis to study the details of the structures.

PHYSIOLOGY

Thirty-five hours of lectures with demonstrations may be required. Physiology of respiratory mechanism and control of gaseous exchange and carriage, reflex control of circulation, cardiac output and pressure cycle and peripheral resistance regulation of body temperature and survival at low temperature, mechanism of gastric secretion, physiology of colon, liver, applied physiology of bladder, physiology of various endocrine organs—adrenal, pituitary, thymus, parathyroid—sex hormones, physiology of reproduction, physiology of new-born, physiology of nephron, pain and shock, and demonstration of cardiac and respiratory functional tests, nitrogen balance studies, etc. are all to be included in the programme.

BIOCHEMISTRY

An average of 40 hours of teaching and demonstrations may be considered the minimum for this important subject. The important topics to be covered are—chemical composition of man, techniques of balance studies, energy exchanges, food values, energy expenditure, BMR, water balance, electrolyte balance, vitamins and accessory food factors, enzymes, coenzymes, metabolism of carbohydrates, proteins, fats, plasma proteins, buffer systems of the body and control of hydrogen ions, inborn errors of metabolism, interpretations of the results of biochemical estimations with chromatography, electrophoretic and colorimetric techniques.

PHARMACOLOGY

Lectures and demonstrations for 35 hours are to be considered the minimum to cover the various topics important to the postgraduates of these specialities. Narcotics, non-narcotic analgesics, central nervous stimulants for asphyxia neonatorum, use of cholinomimetics in post-operative atonia of the gut and bladder, pressor agents and plasma expanders, use of antibiotics, steroid hormones, sex hormones in gynaecological practice, antiseptics and disinfectants, antiemetics with special reference to toxaemia of pregnancy, drugs acting on uterus, oral contraceptives and advances in the therapy of anti-hypertensives, anti-coagulants, and newer diuretics.

MICROBIOLOGY

The mode of spread of infection, infections, anaerobic infections, intestinal infections, tuberculosis, syphilis, sterilization procedure, antiseptics and antibiotics, immunity and hypersensitivity, hospital infections, viruses and parasitology—these topics are required to be studied.

GENERAL PATHOLOGY

The topics to be studied are as follows: Inflammation, regeneration and repair, granulomatous inflammation of special sites, shock and metabolic response to injury, surgical aspects of repair, applied pathology of gangrene, blood coagulation and its abnormalities, hypertrophy and atrophy, hyperplasia, metaplāsia, neoplasia, aetiology of tumours, invasive and metastatic growths neoplasms of epithelial tissues, connective tissues.

SPECIAL PATHOLOGY

The topics to be included are: Reactive response and neoplasms of reticulo-endothelial system; benignty and malignancy; anaemias and anaemia of pregnancy; non-inflammatory pulmonary and cardiovascular disease, renal pathology, liver pathology, bilirubin metabolism, pathology of skeleton rickets and osteomalacia, rheumatic disease, pathology of endocrine system; pathology of cerebrospinal fluid; transplantation of tissues and organs; hormones and hormone assay, biopsy and frozen sections.

SPECIAL GYNAECOLOGICAL PATHOLOGY

This could preferably be dealt with when the candidates are attending to their clinical studies. Diseases of vulva and vagina, histology of cervix and benign lesions of cervix, cervicitis, cervical erosions and cervical polyp, carcinoma cervix, histology of endometrium and hyperplasia of endometrium, endometritis, carcinoma of endometrium. Myoma, adenomyosis, sarcoma uterus, and histology of fallopian tubes, salpingitis, tumours of tubes, and parovarian structures. Embryology and histology of ovaries, inflammatory diseases of the ovary. Classification of ovarian tumours, non-neoplastic cysts of ovary. Cyst adenoma of the ovary, primary carcinoma of the ovary. Metastatic ovarian cancer, Brenner tumour of the ovary, dysgerminoma of the ovary. Feminizing tumours, granulosa cell and theca cell tumours, virilizing ovarian tumours, arrhenoblastoma, adrenal and hilus cell tumours. Ectopic pregnancy, pelvic endometriosis. Fertilization, implementation and placentation. Abnormalities and diseases of placenta and appendages. Pathology of abortion. Hydatiform mole and chorionepithelioma. Cytopathology in obstetrics and gynaecology.

To cover all these topics in 3 months, time at least 5 hours a day will have to be devoted by the postgraduates exclusively to these subjects. In order that the students may take proper interest, it is very desirable that this course should be followed by a written and practical examination, which should form Part I of the examination of M.D. and M.S. degrees offered by the university and with this the teachers of the various basic medical sciences should be associated. Unless this is done, the aim and object of the essential teaching in the basic medical sciences would not be satisfactorily fulfilled. As a good many topics of these basic medical sciences are common for all the postgraduates of clinical subjects, an integrated preliminary course for all

the postgraduates of all the clinical subjects is to be followed by the teaching of special topics pertaining to each speciality and in the present case concerning obstetrics and gynaecology.

The above is the detailed teaching programme for the postgraduate degrees of M.D. and M.S. in obstetrics and gynaecology and for the diploma students of D.G.O. shorter course of six weeks. A few important topics out of those mentioned under each subject will have to be instituted devoting a total of about 150-200 hours in order to give them a broad coverage of the fundamental knowledge of allied and ancillary subjects.

Postgraduate Teaching in Basic Medical Sciences for Postgraduates of
Obstetrics & Gynaecology

1. Anatomy: Lectures and Demonstrations—45 hours, Practicals—30 hours. Total—75 hours.

A. Schedule of Lectures and Demonstrations (Combined 2 hours each).

1. General anatomy of the abdomen I.
2. General anatomy of the abdomen II.
3. Regional anatomy of the abdominal organs I.
4. Regional anatomy of the abdominal organs II.
5. Anatomy of the female bony pelvis.
6. Anatomy of the pelvic floor and perineal diaphragm.
7. Anatomy of the female genital organs.
8. Anatomy of the female genital organs II.
9. Anatomy of the female genito-urinary organs.
10. Development of the human embryo.
11. Development of the human embryo II.
12. Development of the human embryo and common abnormalities of uterus and vagina.
13. Development of the human embryo and common abnormalities of broad ligament and ovary.
14. Multiple pregnancies.
15. Elementary genetics I.
16. Elementary genetics II.
17. Growth pattern and normal growth during intra-uterine development.
18. Micro-anatomy of female genital organs I.
19. Micro-anaotmy of female genital organs II.
20. Micro-anatomy of female genital organs III.

2. Physiology: Lectures—25 hours. Demonstration—10 hours. Total—35 hours.

B. Practical Work: Ten sessions (2-3 hours each). Dissection of the female pelvis to study the details of the structures therein.

1. Physiology of adrenal gland I.
2. Physiology of adrenal gland II.
3. Physiology of nephron I.

4. Physiology of nephron II.
5. Regulation of body temperature and survival at low temperature I.
6. Regulation of body temperature and survival at low temperature II.
7. Pituitary hormones, anterior and posterior.
8. Sex hormones. Pituitary gonadotrophins.
9. Sex hormones. Human chorionic gonadotrophins.
10. Sex hormones. Oestrogen, progesterone, androgens.
11. Physiology of thyroid.
12. Physiology of the newborn.
13. Physiology of pain.
14. Physiology of shock.
15. Physiology of placenta, endocrinology of pregnancy.
16. Nutrition and reproduction.
17. Applied physiology of bladder.
18. Respiratory mechanism and control.
19. General physiology of nerve transmission I.
20. General physiology of nerve transmission II.
21. Physiology of junctional region of nervous systems.

Demonstrations

1. Cardiac function tests.
2. Respiratory function tests.
3. Nitrogen balance.
4. Physiology and electrophysiology of heart.
5. Reflex control of circulation.

3. Biochemistry: Lectures—30 hours. Demonstrations—10 hours. Total—40 hours.

1. Chemical composition of man.
2. Principles and techniques of balance studies.
3. Energy exchanges food values.
4. Energy expenditure B.M.R.
5. Water balance.
6. Electrolyte balance.
7. Vitamins and accessory food factors.
8 Vitamins.
9. Enzymes, classification, properties.
10. Coenzymes. Enzymes and ISO enzymes in diagnosis of disease.
11. Carboydrate metabolism I.
12. Carboydrate metabolism II.
13. Protein metabolism.
14. Lipid metabolism.
15. Plasma proteins.

16. Buffering system of the body and control of hydrogen ions I.
17. Buffering system of the body and control of hydrogen ions, acidosis and alkalosis II.
18. Inborn errors of metabolism.
19. Nucleic acids, structure, genetic code and mutations.
20. Mucopolysaccharides and glycoproteins.

Demonstrations

1. Chromatograph, principles, application of paper, column, thin layer and gas chromatography.
2. Paper (starch gel). Electrophoresis, principles and applications.
3. Colorimetry and spectrophotometry, principles and application.
4. Flame photometry, fluorimetry, principles and applications.
5. Radio-isotopes technique, principles and applications.
6. Errors of estimation.

4. **Pharmacology:** Lectures—25 hours. Demonstrations—10 hours. Total—35 hours.

1. Narcotics including general anaesthetics, opiates, synthetic opiates with special reference to relief of pain in labour.
2. Non-narcotic analgesics.
3. Central nervous stimulants with special reference to the treatment of asphyxia neonatorum.
4. Use of cholinomimetics in post-operative atonia of the gut and the bladder.
5. Pressor agents and plasma expanders.
6. Use of antibiotics in gynaecological practice.
7. Use of steroidal hormones, anti-inflammatory and anabolics in gynaecological practice.
8. Use of hormonal agents in gynaecological practice.
9. Antiseptics and disinfectants.
10. Antiemetics with special reference to vomiting of pregnancy.
11. Drugs acting on the uterus.
12. Oral contraceptives.
13. Advances in therapy.
    (a) Antihypertensives.
    (b) Anti-coagulants.
    (c) Anti-tussives.
    (d) Newer diuretics.

N.B: Thirty-five hours teaching, 10 hours demonstration and 25 lectures of 1 hour each.

5. **Pathology:** Lectures—100 hours. Demonstrations—20 hours.

(a) *Microbiology*

1. Modes of spread of infection. 2. Wound infections. 3. Anaerobic infections. 4. Intestinal infection. 5. Sterilization procedures. 6. Antiseptics and anti-

4. Physiology of nephron II.
5. Regulation of body temperature and survival at low temperature I.
6. Regulation of body temperature and survival at low temperature II.
7. Pituitary hormones, anterior and posterior.
8. Sex hormones. Pituitary gonadotrophins.
9. Sex hormones. Human chorionic gonadotrophins.
10. Sex hormones. Oestrogen, progesterone, androgens.
11. Physiology of thyroid.
12. Physiology of the newborn.
13. Physiology of pain.
14. Physiology of shock.
15. Physiology of placenta, endocrinology of pregnancy.
16. Nutrition and reproduction.
17. Applied physiology of bladder.
18. Respiratory mechanism and control.
19. General physiology of nerve transmission I.
20. General physiology of nerve transmission II.
21. Physiology of junctional region of nervous systems.

Demonstrations

1. Cardiac function tests.
2. Respiratory function tests.
3. Nitrogen balance.
4. Physiology and electrophysiology of heart.
5. Reflex control of circulation.

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2. Principles and techniques of balance studies.
3. Energy exchanges food values.
4. Energy expenditure B.M.R.
5. Water balance.
6. Electrolyte balance.
7. Vitamins and accessory food factors.
8 Vitamins.
9. Enzymes, classification, properties.
10. Coenzymes. Enzymes and ISO enzymes in diagnosis of disease.
11. Carboydrate metabolism I.
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13. Protein metabolism.
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15. Plasma proteins.

16. Buffering system of the body and control of hydrogen ions I.
17. Buffering system of the body and control of hydrogen ions, acidosis and alkalosis II.
18. Inborn errors of metabolism.
19. Nucleic acids, structure, genetic code and mutations.
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Demonstrations

1. Chromatograph, principles, application of paper, column, thin layer and gas chromatography.
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1. Narcotics including general anaesthetics, opiates, synthetic opiates with special reference to relief of pain in labour.
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4. Use of cholinomimetics in post-operative atonia of the gut and the bladder.
5. Pressor agents and plasma expanders.
6. Use of antibiotics in gynaecological practice.
7. Use of steroidal hormones, anti-inflammatory and anabolics in gynaecological practice.
8. Use of hormonal agents in gynaecological practice.
9. Antiseptics and disinfectants.
10. Antiemetics with special reference to vomiting of pregnancy.
11. Drugs acting on the uterus.
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13. Advances in therapy.
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N.B: Thirty-five hours teaching, 10 hours demonstration and 25 lectures of 1 hour each.

5. Pathology: Lectures—100 hours. Demonstrations—20 hours.

(a) *Microbiology*

1. Modes of spread of infection. 2. Wound infections. 3. Anaerobic infections. 4. Intestinal infection. 5. Sterilization procedures. 6. Antiseptics and anti-

biotics. 7. Immunity. 8. Hypersensitivity. 9. Viruses. 10. Viruses. 11. Hospital infections. 12. Parasitology.

(b) *General Pathology*

13. Inflammation, vascular response I. 14. Inflammation, cellular response II. 15. Inflammation in special sites. 16. Inflammation in special sites. 17. Granulomata. 18. Tuberculosis. 19. Syphilis. 20. Shock and metabolic response to injury. 21. Regeneration and repair I. 22. Regeneration and repair II. 23. Surgical aspects of repair. 24. Blood coagulation and its abnormalities. 25. Applied pathology of gangrene. 26. Hypertrophy and atrophy. 27. Hyperplasia and metaplasia. 28. Neoplasia. 29. Benignty and malignancy. 30. Neoplasms of epithelial tissues I. 31. Neoplasms of epithelial tissues II. 32. Neoplasms of epithelial tissues III. 33. Neoplasms of connective tissues. 34. Aetiology of tumours I. 35. Aetiology of tumours II. 36. Phenomenon of invasive and metastatic growths.

(c) *Systemic Pathology*

37. Pathology of inflammatory pulmonary diseases. 38. Pathology of non-inflammatory pulmonary disease. 39. Non-inflammatory disease of the cardiovascular system. 40. Rheumatic disease I. 41. Rheumatic disease II. 42. Anaemias. 43. Anaemia in pregnancy. 44. Pathology of liver I. 45. Pathology of liver II. 46. Bilirubin metabolism. 47. Reactive phenomena + neoplasms of reticuloendothelial sytem I. 48. Reactive phenomena + neoplasms of reticuloendothelial system II. 49. Renal pathology I. 50. Renal pathology II. 51. Pathology of skeleton I. 52. Pathology of skeleton II. 53. Pathology of skeleton III. 54. Cerebrospinal fluid circulation and its pathology. 55. Pathology of endocrine system I. 56. Pathology of endocrine system II. 57. Pathology of endocrine system III. 58. Hormones and hormone assay in relation to cancer. 59. Endometrium. 60. Transplantation of tissues or organs. 61. Biopsy and frozen sectioning in tumour diagnosis. 62. Cytology.

(d) *Special Gynaecological Pathology*

1. Diseases of the vulva and vagina. 2. Histology of the cervix, benign lesion of cervix, cervicitis, cervical erosion and cervical polyp. 3. Carcinoma cervix. 4. Histology of endometrium, hyperplasia of endometrium, endometritis and other benign condition of endometrium. 5. Carcinoma of endometrium. 6. Myoma, adenomyosis, sarcoma uterus. 7. Histology of fallopian tubes salpingits, tumours of tubes paraovarian and uterine ligament. 8. Embryology and histology of ovaries. Inflammatory disease of ovary. 9. Classification of ovarian tumours. Non-neoplastic cysts of the ovary. 10. Cystadenoma of the ovary. 11. Primary carcinoma of ovary. 12. Metastatic ovarian carcinoma, Brunner

tumour of the ovary. 13. Dysgerminoma of the ovary, feminizing tumours, granulosa cells and theca cell tumours. 14. Virilizing ovarian tumours, arrhenoblastoma, adrenal and hilus cells tumours and other tumours. 15. Ectopic pregnancy. 16. Pelvic endometriosis. 17. Fertilization, implantation placentations. 18. Abnormalities and diseases of the placenta and appendages. 19. Pathology of abortions. 20. Hydatiform mole and chorion-epithelioma. 21. Cytopathology of gynaecology and obstetrics.

6. Social and preventive medicine

Lectures—10.

I. Medical statistics, 5 lectures. II. Sociology, culture, customs, beliefs, faiths, 1. III. Family structure. 2. IV. Heredity, genetics, distribution of genes, races, 2.

biotics. 7. Immunity. 8. **Hypersensitivity.** 9. Viruses. 10. Viruses. 11. Hospital infections. 12. **Parasitology.**

(b) *General Pathology*

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THESIS OR DISSERTATION AS REQUIREMENT

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Professor and Head of the Department, Obstetrics and Gynaecology, K.G. Medical College, Lucknow

NO unanimity has been reached in the matter of thesis or dissertation as a requirement for postgraduate work. Most universities include the submission of a thesis as requirement; others prescribe a dissertation. But even amongst the teachers of universities where the thesis is obligatory, there are two schools of thought: one which feels that the preparation of the thesis is a very valuable exercise in the intellectual development of the postgraduate and the other which claims that the thesis should be replaced by a dissertation as the preparation of the former takes up so much of the candidate's time and energy that very little is left for the acquisition of the clinical skills necessary for the making of the specialist in obstetrics and gynaecology.

The first point for discussion, therefore, will be the merits of the thesis *vs.* dissertation. The second (which arises only if the superiority of the thesis is accepted) is how much time should be devoted to the preparation of the thesis and how much before the date of the examination should the thesis be submitted and accepted.

To my mind the preparation and submission of a thesis is essential if the training we wish to give is to be "education" in the true sense of the word and is not merely to mean cramming to pass an examination. The reading necessary to review the existing literature on the subject under investigation widens the intellectual horizons of the student and takes him beyond the orbit of his text-books. Moreover, he learns how to correlate, retain and integrate information already recorded by others and also to evaluate critically the recorded facts.

If a laboratory discipline is involved then he has to master its technique, thereby acquiring familiarity with present-day investigational methods. The writing of the thesis too is a valuable training, for a student learns to communicate his thoughts in a logical manner and this should prove of great help in later professional life in the writing of articles or reviews. This is particularly important in the present times when all of us are concerned about the poverty of expression displayed by candidates during examinations, in written answers as in *viva voce*.

Another argument frequently cited against the writing of thesis is that no research worth the name is being done and hence the time spent in preparing thesis could be spent in more useful persuits. It is too much to expect that any one in the short period of 6-12 months, which is usually allocated for the preparation of a thesis, would be able to produce something spectacular in the field of research. What is important is that the writing of a thesis is an introduction for the student to research methods and orderly thinking; it helps to evaluate critically. Our future teachers will be drawn from the ranks of those we are training today

and such broad-based training is essential to produce "teacher-clinicians" who can hand the torch of their learning and experience to the next generation.

I would make a plea here that we desist from referring to "teaching *vs.* research" or "clinical training *vs.* research" but consider the two as closely interrelated areas both of which are essential for postgraduate education in the true sense of the word and in this wider concept of postgraduate education the thesis has a very important role to play.

Having set forth in brief the main advantages of the thesis, I would here make a strong plea for its retention.

TIME FOR PREPARATION OF THESIS

My contention is that the second year of this three-year period is the best time for the preparation of the thesis and the student should be permitted to submit it either at the end of that year or later if he so desires. But six months should elapse between the date of submission of the thesis and the examination for which it has been submitted. Registration for the thesis should be permitted 6 months after graduation to all house-staff working in departments of obstetrics and gynaecology and this should be completed by the end of the first year. Earlier than this period, registration is not recommended as it is very difficult to judge a student's aptitude immediately after his graduation and the choice of a suitable subject for the thesis becomes difficult. The minimum period of time to be spent for the preparation of the thesis should be specified and should not be less than one year but there need be no maximum limit, the only restriction being that the candidate should have submitted the thesis 6 months before his examination.

Before a final verdict can be given on the question of thesis *vs.* dissertation as requirement, one other important fact needs consideration. If the thesis is made the only obligatory requirement, the number of postgraduates who can be accepted for training in any particular year must necessarily be restricted, for no teacher however industrious or illustrious, can supervise more than three theses in one year. At many centres, today, it is not unusual to find a single teacher guiding as many as 8 to 10 theses (and in some cases even more) and under such conditions the guidance must necessarily be perfunctory and casual.

With the increasing trend toward specialisation, more and more postgraduates would wish to register for M.D. and M.S. courses at different centres every year, but not all centres have enough experienced teachers to act as guides for all those who would wish to undergo this training. What are we to do under these circumstances? Should we dissuade these young men and women from specialising or could we offer them some other alternative? Could the writing of a dissertation be an alternative? If this is effected then the number of postgraduates that can be allotted to a teacher can be greater than the number if the thesis is the requirement.

This theme requires to be elaborated a little further. I am, by no means, advocating the abolition of the thesis for there is no doubt whatever of its superior educational value over the dissertation, and the thesis should remain the requirement in the case of candidates who will later become teachers in the specialty. But a dissertation may be a better alternative for those who will become practising specialists. The latter would not be considered eligible for

recruitment to teaching posts but would be able to render professional service of a high standard to the community.

It may be argued that for one and the same examination we should not have two types of requirements, but just as there is M.A. (Pass) and M.A (Hons.) so there could be M.D. or M S. "with dissertation" and M.D. or M.S. "with thesis" This may seem a revolutionary recommendation but it would enable us to have both types of specialists: teachers as well as trained obstetricians and gynaecologists.

Enlightened reform is urgently required in our postgraduate curricula and I put forward the plea that the requirement be kept as "either thesis or dissertation" rather than "only *thesis" or "only dissertation."*

METHODS OF ASSESSMENT

K. N. Mitra

Honorary Colonel and Consultant, A.F.M.S., India, Professor and Director of Obstetrics & Gynaecology, Medical College of Bengal, Calcutta

THE word "assessment" is usually used in the sense of estimating the amount of taxation or fine to be paid by a person or community. This presumes that the assessor has got an adequate capacity to get the maximum out of the assessee. Unfortunately, in the words of Burke, "To tax and to please, as to love and be wise, is beyond humanity."

We may, therefore, take it for granted that any method of assessment is open to criticism and no method can please everybody. Therefore, I take up my assignment with considerable hesitation.

To measure any object, a certain arbitrary and previously agreed standard is taken for granted. It is easy to determine the physical properties, such as height, weight, temperature, etc. On the other hand, it is not so easy when we try to assess the abstract qualities of a subject or person, be it for a job, for suitability in a profession or for preliminary screening of candidates for training in some special subjects.

In this realm of uncertainties, it is indeed difficult to interpret figures (e.g. marks in examinations) ascribed to such objective assessment. It is true that it is extremely easy to do the arithmetic but it is easy and fatal to think that the accuracy of the arithmetic is equal to the assessment of the problem.

We are not aware of any specific standard or standards which have been laid down, with which comparison may be made of the performance of a candidate in higher medical examinations, except that which has been evolved with custom and tradition. It is not a single quality but many different qualities which we are supposed to evaluate in a particular candidate and this further complicates our problem.

There are three levels of knowledge which can be acquired by aspirants in scientific medicine:

(a) Research scientist

(b) Technologist

(c) Technician

In our country, the last category comprises diplomates in obstetrics and gynaecology (D.G.O.).

The average M.D. in our estimate should be a good technologist. The more brilliant and sophisticated among them will later become leaders of their speciality.

In case of assessment of M.D. candidates, three variables need consideration:

1. Examiners
2. Examinees

3. Method of assessment (examination)

At present, there are over 70 medical colleges affiliated to about 50 universities who can train and examine candidates for higher medical examinations. The M.D. examinations of our universities form the theme of this discussion.

I. EXAMINERS

From my own experience I feel that it takes at least four to five years of practical experience as M.D. examiner to acquire objectivity, detachment and maturity to assess candidates.

At present, it is nearly impossible to get a panel of experienced examiners for this examination in different universities every year. This has led to wide discrepancy in the standard of evaluation of candidates not only between different universities but in the same university at different times.

This, apart from the reason of uniformity, prompts me to suggest a zonal system of examination. We could have five zones in India—north, south, east, west and central. All the universities in a particular geographical zone will pool their resources to conduct the examination in one centre annually. The centres can rotate. An experienced panel of six or eight examiners should be entrusted to conduct the examination. This will ensure more uniformity, improve the objectivity, and minimise the variability and chance factors to a considerable degree. It need not interfere with the autonomy of the universities as one or more university teachers will be included in the panel of examiners when their own students are examined.

2. EXAMINEES

At the moment only about a third to half of the students are successful in M.D. examination which means that either the initial selection of students has been faulty or the criteria or standards of assessment are defective. If the initial selection of the candidate is done with care, then ninety per cent of the candidates should be able to qualify in the examination, if the training programme has been arranged with foresight and executed properly. This aspect has been dealt with already and needs no further elaboration.

3. METHOD OF ASSESSMENT (EXAMINATION)

It is not possible to explore the total knowledge of a candidate. So a representative sample of his knowledge is subjected to scrutiny in an examination or, to use a phrase from statistics, a sample survey of the knowledge of the candidate is conducted. This could be done at or about a particular time (cross-sectional survey) or over a period of time (longitudinal survey).

When a large number of candidates has to be examined, our system of examination has got the virtue of economising on time and is perhaps better suited for M.B B.S. examination.

On the other hand, when the number of candidates is small, it is desirable and important to evaluate their total performance during their whole period of training as well as at the time of examination. Indeed, for postgraduate students, sufficiency of training deserves equal emphasis with examination.

In the light of the above, I venture to suggest the following altered method of assessment in M.D. (obstetric and gynaecology) examination:

1. Thesis. It should be optional and if elected by the candidates should exempt them from a part of theory examination.

2. Theory Papers :

(a) First Paper—Essay type—Candidates opting for a thesis which is subsequently approved should be exempted from this paper.

(b) Second and Third Papers—should be of multiple-choice type—each consisting of 100 questions.

3. Clinical. Record of actual hospital work (operations and deliveries) personally done by the candidate should be compiled and submitted for scrutiny to and discussion with the examiners. This record should also include the remarks of different teachers of the department regarding regularity of attendance, capacity to assume responsibility, of the candidate.

4. Practicls. Some sort of objective test, for example, simple operations on animals or fitting up of a small experiment or operation, should be added to our present-day procedures.

5. Oral Examination. This should be designed to find out the personality of the candidate, his alertness, and his knowledge of local and national problems of medicine as well as his power to communicate lucidly and without ambiguity.

REPORT OF THE SUB-COMMITTEE ON OBSTETRICS AND GYNAECOLOGY

DR. M. K. K. MENON

Chairman, Director and Professor, Institute of Obstetrics and Gynaecology, Govt. Hospital for Women and Children, Madras

DR. B. N. PURANDARE

Rapporteur, Obstetrician and Gynaecologist, Bombay

POSTGRADUATE training in obstetrics and gynaecology should provide for academic and research careers as well as for specialist service in non-teaching hospitals. The existing two-year degree course is totally unsatisfactory for an academic and research career in obstetrics and gynaecology and the present one-year diploma course is likewise insufficient to train a clinical specialist. Hence, a two-year diploma course is recommended for non-teaching specialists, a three-year degree course for teachers and investigators.

Selection of candidates

All candidates should have completed the one year of senior home-surgeoncy in medicine and surgery in a recognised hospital after full registration (not necessarily in a hospital attached to a college). The compulsory rotating pre-registration house-surgeoncy internship is part of the M.B.B.S. course and should not be taken as house-surgeoncy for purposes of selection. Academic merit and experience alone should be the criteria for selection. The selection should be by an interview before a board where the candidate's ability to express ideas and other factors could be assessed. The professor-in-charge of postgraduate training should be given a free hand in the selections.

Training

Training for the M.D. should include the basic sciences and allied disciplines—applied anatomy, physiology, biochemistry, pathology, medicine, radiology, etc., pertaining to obstetrics and gynaecology. The departmental heads should work out the detailed programme in close collaboration with the departments of basic medical sciences and allied disciplines. Where such collaboration is not possible or the basic sciences departments are not developed to impart the required training, it is unwise to institute postgraduate training in the speciality.

During training in the speciality, students must be made responsible for patient care and given all opportunities for proper investigation and operative procedures first under guidance and later independently. Graded responsibility should be the objective. Clinical discussions,

clioico-pathological conferences and seminars wherein the students play tbe major role would he preferahle to didactic lectures. Audio-visual aids are essential.

During the first three months of training, the professor should he given the cboice of weeding out those who will not make the grade.

Coosidering facilities and guidance and time availahle, a dissertation not exceeding 3,000 words on a cbosen subject worked oo by the candidate and untilising local material is recommended.

Assessment

Periodic assessment during the training is important. In the absence of anytbing hetter, the final assessment has to be hy an examination. There should he one paper on basic medical science in relation to the speciality, another on medicine and allied disciplines in relatioo to the speciality, one in obstetrics and one in gynaecology. This should be followed hy a clinical and an oral examination which will be hroad-based including pathological specimens, slides, radiograpbs, instruments, etc. The candidates sbould be questiooed on their dissertatioos at this time. The examination must be aimed at finding out whetber the candidates have observed tbe fundamental and basic principles in a scientific manner. Tbey sbould not he meant to test the caodidates' knowledge of some detailed and obscure developments. It should be understood that tbe passing of the examination only means that a good foundation has been laid for huilding a good superstructure. As far as possible, all examinatioos sbould he over by tbe eod of April for the convenience of tbe student.

Diploma course

The diploma course of two years is meant to provide good clinical specialists. Emphasis should be mainly on clioical and practical obstetrics and gynaecology. The examination should consist of ooe paper eacb in obstetrics and gynaecology followed by a clinical and oral examioatioo. Students should suhmit case records and commentaries on 20 patieots atteoded to by them personally.

After the diploma, a candidate can proceed to the degree course if be so desires hy completing an additional 2 years of training.

Institution requirements

All students must be full-time and not engaged in practice. They must be given accommodation and scholarships. Adequate library facilities and guidance at all levels must be availahle to them. No postgraduate professor should have under him more than two or three students at a time.

Exehange of staff and students between different postgraduate centres should be encouraged.

POSTGRADUATE MEDICAL EDUCATION

PROF. S. P. GUPTA

Professor and Head of the Department of Ophthalmology and Chief Eye Surgeon, Gandhi Memorial and Associated Hospitals, Lucknow

IN order to chalk out a common programme for postgraduate medical education, it is essential that we should have common syllabus for undergraduate medical education.

We should consider whether postgraduate medical education should be permitted in institutions where no undergraduate training is given. I for one believe that in postgraduate education collaboration with pre-clinical, para-clinical and clinical departments is essential not only for proper training and research but also for maintaining proper academic atmosphere so essential for higher studies.

The following nomenclature should be followed for postgraduate qualifications:

(1) Diploma in ophthalmic medicine and surgery (D.O.M.S.).

(2) Master of Surgery in ophthalmology (M.S.).

There should be standard criteria for selection of candidates for the above diplomas and degrees.

These selections should be made by a council of postgraduate medical education and the research department of the college after being recommended by the head of the department. Obviously the sole criterion for selection should be merit.

After having graduated from a recognised medical college and having worked as a house surgeon for one year, the candidate should be interviewed and decision taken as to his fitness for the postgraduate course.

If he is of average ability and has inclination to settle as an eye practitioner he or she may be selected for the diploma course. I feel that this should be a whole-time course for one academic year and the student should be permitted to work as a house surgeon or resident during this period. He should be given responsibility for investigations into pre- and post-operative care and must learn the details of all operations. This to my mind gives him practical training which is so essential for a postgraduate doctor. The diploma should consist of two examinations: Part I dealing with anatomy of the eye, physiology of the eye, and optics, and Part II dealing with clinical ophthalmology, operative surgery and pathology of the eye.

This training in basic sciences preferably should be given by the anatomist and the physiologist. Optics should be taught by teachers of ophthalmology after the candidate has gained a basic knowledge on optics taught by a physicist. Special classes should be arranged for medical ophthalmology and radiology.

Candidates for M.S. should be selected after interview taking into consideration their past record and aptitude. The selection should be on merit by a council of postgraduate education and should also depend on the need of the state or region concerned.

The institutioo should he recognised to impart diploma or degree courses and should have at least 50 beds for ophthalmology.

The candidate should appear for postgraduate degree examinatioo (M.S.) 3 years after graduation. Of these three years, one year's house surgeoncy in a recognised teaching hospital (of which at least six months in ophthalmology) is essential. For the next two years, the student may he attached to the department concerned under a supervisor except when he is attached as a *teacher in a teaching institution* when *his presence* for *one year should he compulsory*. For Ph.D. or D.Sc. he should be required to work for at least 2 years after having taken his M.S. (ophtbalmology) degree.

METHOD OF TRAINING

Candidate for M.S. (opbthalmology) should undergo six months of training in basic medical sciences like anatomy, physiology, pharmacology, biochemistry and pathology. This period may be spent as a whole-time or part-time attachmeot to basic medical departments or be may nttend courses of lectures and demoostrations io these subjects. For tbe period of two years he should be working in the main department and should be responsible for patient care.

Seminars, clinico-pathological conferences and symposia should be arranged perindically. Postgraduate extension lectures should be arranged.

PATTERN OF TRAINING

(1) Clinical work
(2) Bedside clinics or clinical demonstration
(3) Out-patients work
(4) Operative work
(5) Seminars and clinico-patbological conferences
(6) In cbarge of beds

It will be helpful if all postgraduate students are taught research metbodology and entrusted with a research project. The result of this work ooly should be presented in the form of a thesis and not dissertation. The thesis should be presented six months before the examination and its acceptance should be essential for appearaoce in the final examination. For this purpose there should he proper research facilities in ophthalmology department or a central research laboratory. Assistance may he had from departments of basic medical sciences to work on the thesis under a recognized teacher who should have at least 7 years of teaching experience and is *a permanent member of the staff.*

The subject of thesis and research guide should be approved hy the postgraduate council and then he registered with the university. Not more than four theses should be undertaken every year.

EXAMINATION AND ASSESSMENT

For D.O.M.S. there should be an examination after study for one academic year consisting of one part.

Each State should determine its requirements. Examination should be governed hy a post-graduate council, each region having one or two centres where examinations are conducted.

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METHODS OF SELECTION AND REQUIREMENTS OF POST-GRADUATE STUDENTS IN OPHTHALMOLOGY

DR. N. K. MUNSI

Professor of Ophthalmology, R. G. Kar Medical College

METHODS now prevailing for selection of candidates are (a) holding of competitive examination, (b) results of last professional examination, (c) interview and (d) evaluation of the past records. As each has got its merits and demerits, a candidate is required to qualify in either one or more of the above processes, which again depends on demand and supply and the importance of the course.

Resident house job for six months in general surgery and for six months in general medicine are very essential for every graduate. It will be of immense help to him irrespective of the line he chooses in future. Mr. Mehta remarked that specialists must have a very good overall knowledge of general medicine. They must cultivate the faculty of observation and inquisitiveness. They must be very precise and thorough while observing, reading, writing or working. During this period of training, every doctor must be compelled to keep record of his patients under respective disease headings. He must put his own remarks in every case. This will cultivate the research habit, and the faculty of observation of a candidate could easily be assessed from these records, at the time of selection.

Postgraduate education is the expansion and extension of undergraduate curriculum. Mr. Reddy remarked that the traditional way of the postgraduate to graze the pastures of clinical fields on his own for gathering information and experience, supplemented by lectures of the professors or by the visiting professor for 3 to 6 months, is neither popular nor very effective with the students. Dr. Nayar, our Union Minister of Health, has again urged for reorientation of the course of postgraduate studies and advocated the improvement of the percentage of failures. This is necessary for national emergency.

As per definition, postgraduate instruction and residential house training in the line of the speciality should run concurrently.

It is obvious that for postgraduate medical education an adequate number of trained teaching personnel of the level of professors, associate professors, readers and lecturers should be made available in ophthalmology. Ocular biochemists and pathologists are essential for guiding research and helping in thesis work in the department.

For postgraduate training at least 50 beds should be assigned for ophthalmology and the unit, should consist of the professor, assistant professor or reader, lecturer, refractionist, registrar and residents or house-surgeons. There should be a well equipped operation theatre, for aseptic and septic work, with equipment such as slit lamp with accessories for genioscopy, Perimeter, Bjerrumhs and Heiss Screen, Syneptophore, Electric Indirect Ophthalmoscope, Keratometer, Diathermy apparatus, and Giant magnet to remove foreign bodies.

A panel of postgraduate teachers should be maintained by every university and by every centre where it is decided to open postgraduate training. These teachers should have the requisite qualifications and research work to their credit and teaching experience of at least ten years as professor or reader or honorary staff or equivalent.

It will be better if examiners are selected from a panel of professors qualified in postgraduate training and examination.

The period of training and studies and selection of postgraduate students should be uniform and also the standard of examination and assessment should be the same. Facilities such as library, hostel, etc. should be available for all postgraduate students. There is an urgent need to improve postgraduate medical education in all its aspects and bring it on the same level as in other advanced western countries.

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Moreover, students *cum* house-officers must follow every case from the stage of admission to the stage of recovery or loss. They must keep record of the cases in their own record books under respective headings of the diseases and must write short summary and prepare discussion notes of the diseases under the remarks column. During this period of clinical study, students must have easy access to a well equipped pathology laboratory and should be provided with a library maintaining all the latest editions of books and outstanding scientific journals.

While discussing so much about the clinical aspect, one should not forget about the basic sciences and the preclinical medical sciences. Knowledge of these sciences is of tremendous importance in relation to ophthalmology, a subject which a graduate has come to learn at an adult level, while he is still in infancy. He knows nothing about the anatomy and the

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A panel of postgraduate teachers should be maintained by every university and by every centre where it is decided to open postgraduate training. These teachers should have the requisite qualifications and research work to their credit and teaching experience of at least ten years as professor or reader or honorary staff or equivalent.

It will be better if examiners are selected from a panel of professors qualified in postgraduate training and examination.

The period of training and studies and selection of postgraduate students should be uniform and also the standard of examination and assessment should be the same. Facilities such as library, hostel, etc. should be available for all postgraduate students. There is an urgent need to improve postgraduate medical education in all its aspects and bring it on the same level as in other advanced western countries.

POSTGRADUATE COURSES IN OPHTHALMOLOGY

DR. PARAS NATH SINHA

Patna

WE require a high grade ophthalmic science for the community at large reaching out to the periphery both in preventive and curative aspects. It is essential to have well organised training both at the undergraduate and postgraduate levels backed by clinical and fundamental research.

At postgraduate level views differ regarding courses, theoretical and practical teaching, standard of examination and their uniformity in different universities.

DIPLOMA IN OPHTHALMOLOGY

This is for those who intend to specialise in ophthalmology but cannot get registered in M S. either for want of competitive merit or for want of time and money. This should be a course of 9 months to a year to enable him to work as specialist in small medical centres like subdivisional hospitals It is worth while considering whether diploma courses, where available, should be made an essential prerequisite to registration for M S. or alternatively whether a diploma holder may sit for the Master's degree examination earlier than the simple medical graduate.

The one-year training, having 9 months of active teaching, should consist of three terms. The first term is to be devoted to lectures and demonstrations in basic medical sciences: anatomy including embryology, physiology including histology and optics, pathology and bacteriology. Respective departments may hold examinations. Didactic lectures should not exceed sixty. More stress should be laid on regular bedside teaching, practical demonstrations, and seminars. There should be liaison between departments of general surgery, medicine, E.N.T., preventive medicine, radiology, pharmacology and therapeutics. At the end of the course an examination should be held.

M.S.

These students should be instructed in the methodology of research:

Prerequisite for admission should be one-year house-surgeoncy in a recognised hospital or six months' house-surgeoncy and diploma in ophthalmology. Selection should be on merit and one postgraduate teacher should not have more than four candidates at a time to guide for the thesis

The course should extend over two academic years after registration and at least 9 months should be devoted to the selected problem of research leading to the preparation of the thesis. There should be panel discussions, clinico-pathological conferences, and journal clubs.

Acceptance of the thesis should be a prerequisite for appearing in written, clinical, and oral examinations.

PH.D.

This is a research degree. In ophthalmology it should come after M.S. If necessary, the candidate should submit to a practical and a viva-voce in the subject of his thesis.

physiology of the eye. Anatomy including its comparative and embryology portions, physiology of vision and that of ocular apparatus, and the biochemistry of eye must be taught by the basic medical science teachers who must attach more importance to their applied aspects besides detailing other descriptions. Clinical teachers too must bring out the correlation between those subjects and the disease processes, as far as they can, while discussing the cases. Optics should again be taught partly by a physicist, partly by a physiologist and partly by a clinician. All should deal with the subject in harmony and treat the matter on an applied basis for understanding the diseases.

THESIS OR DISSERTATION IN POSTGRADUATE OPHTHALMIC EXAMINATION

DR. LALIT P. AGARWAL

Professor of Ophthalmology, CI/15, All-India Institute of Medical Sciences, New Delhi

THE postgraduate examination in ophthalmology can be classified under three headings: (a) Diploma, (b) Degree (M.D.) and (c) Ph.D. The topic under discussion is the requirement of a thesis or dissertation for all the postgraduate examinations.

A student who enrolls himself for the diploma in ophthalmology is making his choice to become a practitioner in ophthalmology rather than to devote himself to a teaching or research career. Personally I do not think that either a dissertation or a thesis should be required from these candidates. I should like to suggest that these students should be encouraged to collate data on various cases that come under their observation either during house-job or during the postgraduate studentship. They should be required to submit 30 case records on different diseases with short comments on their diagnosis and management. Besides this, they should also be required to write two long commentaries—one dealing with basic sciences and pathological aspects; the other dealing with clinical and therapeutic aspects drawing inspiration from their own case records under submission. The commentaries should not exceed 1500 words. This would be a useful exercise as this would help a student to be able to cover a wide range of clinical cases besides developing the habit of keeping careful records which, as we all know, help us to critically analyse the methods of diagnosis and treatment in the light of failures and successes. I am sure this will definitely improve the standard of the clinical practice in ophthalmology.

For the degree course, however, we must seriously consider and weigh the alternatives of dissertation or thesis carefully.

A thesis is a proposition which involves some original observations, while a dissertation is a formal discourse on a subject which need not contain any original work.

In several universities at present the requirement is to write a dissertation while in others it is a thesis. Looking at some of the theses one cannot escape the feeling that some universities accept statistical analysis of a clinical topic as a thesis, but, in truth, it is actually a dissertation. By and large we are at present more inclined towards *dissertation, be it clinical* or otherwise, rather than a thesis. What we have to think over is if the position is satisfactory. As we are situated today, there does not exist a tempo for any kind of research in the country, especially in clinical disciplines; and no country can feed itself only on the intellectual fodder imported from other countries. One of the reasons for this position is lack of orientation of our junior teachers to the problems of research during their training as postgraduates. I am of the opinion that a student going in for a degree should be exposed to a research project which should be planned and executed by himself under the close supervision and guidance of an experienced and qualified teacher. In the planning of the thesis a mandatory provision

METHOD OF TRAINING

DR. T. T. RAMALINGAM

Madras

ONE of the old specialities is ophthalmology and, as science makes rapid advances, interdependence of one subject on the other and the necessity to acquire basic knowledge in allied subjects becomes greater. There should be two postgraduate courses, diploma and M.S degree. For the degree course a candidate must have already passed the diploma course.

He should be taught all essentials of anatomy, physiology, optics, pharmacology, pathology, etc. for the diploma course. He should be guided to perform all major operations on the eye and later encouraged to operate independently. For M.S. degree, his clinical knowledge should be developed to a higher level so that he can teach undergraduates and in course of time postgraduates and, later on, take up research work in the speciality. There should be lectures on basic and allied subjects in relation to ophthalmology or preferably seminars on suitable topics in medical ophthalmology, like diabetes and hypertension where a physiologist, a pathologist, a physician, an ophthalmologist and others can participate. The institution should be well equipped with all the instruments and appliances and postgraduates should be trained to handle them.

For operative surgery the postgraduate should read about an operation like scleral resection and he may assist and later on perform the operation himself assisted by the surgeon.

Postgraduates should be also asked to give clinical demonstrations to the undergraduates.

For submission of thesis they should give case reports of a series of interesting cases seen or statistical reports about incidence of any particular disease.

These institutions should have a well equipped laboratory where section cutting of the eyeball is performed. Ocular pathology should form the basis. There should be a well equipped museum with a selection of photographs and a good library.

METHODS OF ASSESSMENT

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THE methods of assessment of a candidate vary. Broadly speaking, there are two systems: one based on individual assessment of work put in by a candidate throughout his course of studies at an institute and the other on his merit at a qualifying examination. Each system has its advantages and drawbacks and has to be considered separately.

The first system is adopted by the universities in the U.S.A. and on the continent. Here the quality and the amount of work and the studies done by the individual throughout his period of study at the institute is taken into consideration mainly by the professor under whom he works. The main advantage in this system is the incentive that a candidate gets to put in continuous work as well as study throughout the whole period, mainly with his own efforts and, whenever needed, with the help and guidance of the teacher. This creates in the student a feeling of self-reliance; he develops a good grasp of the subject which makes him more practical, so essential in medical education. The student participates in monthly symposia on different subjects and is subject to quarterly written and practical tests by his professor. By these methods the capabilities of an individual can be judged. But the drawback of this system of assessment is the very limited number of students that can be given individual attention by a teacher at a time. It is that the teacher must maintain a uniform level of vigilance and justice whilst assessing the student. However, a great check can be exercised if the final verdict of assessment is pronounced by a council of teachers of allied subjects at the institute.

The second system of assessment through a qualifying examination is the one followed in our country. This is the pattern in British and Commonwealth countries. It is a good system of assessment but the daily work, neither the amount nor its quality, is considered in this assessment. Moreover in this system there is no incentive for the student to work and study continuously but the usual tendency is to do some work during the last months preceding the examination. As a result, often a student who is good in the esteem of his teacher fails to qualify and the mediocre scores over the better one. To prevent such deplorable incidents a candidate who is allowed to sit for the examination should not only satisfy the requirements regarding attendance and lectures, but he should also be declared by his teacher to be fit to sit for the examination.

In the selection of the examiners for these examinations, only those should be considered who have considerable teaching experience in the training of such candidates. At least half the number of the examiners should be from other universities, who should be encouraged to take more active part in the conduct of the examination and the assessment of the candidates.

should be some sort of laboratory work or experimental work. It may be argued that all institutions imparting postgraduate training leading to a degree do not have facilities for such work. My categorical answer to such a problem is that such institutions should be permitted to conduct diploma courses only. To achieve a proper orientation in research, the writing of a thesis should be made compulsory. The guide must actively assist a student in the choice of a subject, after fully assessing the aptitude and the ability of his student to execute such a project. During the first three months the student should be made to collect the published literature on the subject. Then he should be asked to make a bibliography. A good plan would be to ask him to submit summaries of the articles he has read, bringing out all the important points having a bearing on the chosen topic. He should also be asked to consult the abstracts of the articles not available. After this he should be asked to write a complete review of the literature in the form of an essay. When the student has fully acquainted himself with the literature, a proforma should be drawn up which should consist of a short summary of the work done already, aims of the study, plan of the work to be carried out and precise methodology to be employed in detail (including experimental details). It is advisable that it should be discussed in the departmental meeting inviting criticisms and suggestions which should be finally sorted out by the guide. The student should then be allowed to proceed with the work. A wiser course may be that the proforma should be approved by a sub-committee of the faculty which should have a multi-disciplinary approach.

During the thesis all the investigations and experiments should be carried out by the student himself and the same should be incorporated in the thesis. A critical discussion of the recorded observations should then enable him to draw reasonable conclusions.

The thesis should not only be approved by the examiner but should also form subject of the *viva-voce* test along with the examinations when the student must be required to defend his methodology as well as observations and conclusions drawn on the basis of a critical analysis of his work.

There does seem to be a good deal of criticism regarding the thesis forming a requirement for the degree examination. We must be clear in our own mind as to the fundamental aim of the training of a student for the postgraduate degree. Do we not envisage that he will be a junior teacher of both the undergraduate and the postgraduate? During the course of his duties as a junior teacher he will not only execute his research projects but also actively help the postgraduates in his department in their research projects. If this is the concept, then we have to encourage the postgraduate students to research which is both desirable and necessary. We must clearly state that diploma should serve the need of treating surgeons and physicians while a degree holder is and should be encouraged to become a junior teacher. This will also give the much-needed fillip to the research in clinical disciplines, woefully lacking at present.

PH-D.

The degree should be a pure research qualification based on original work only. There does not seem to be any room for difference of opinion with regard to thesis at this stage. The research at this stage should be comprehensive and the student must attempt to solve various aspects of a problem. After the thesis has been approved, a *viva-voce* test should be held at which the student should not only defend his work but should also be expected to show familiarity with the field of work. He should also be able to exhibit a good knowledge of the aspects of basic sciences connected with his project.

TEACHING OF PATHOLOGY AND BASIC SCIENCES IN THE CURRICULUM FOR OPHTHALMOLOGY

P. AWASTHI

THAT teaching of pathology and other basic sciences is an essential part of both undergraduate and postgraduate education is an undisputed fact. I take the liberty of presuming that all those who are present here agree with this. Basic sciences and pathology form the basis of clinical knowledge. One teaches the normal functioning of the body and the other reveals its derailment under pathological conditions. If one does not know the normal functioning of a part, one would never be in a position to appreciate the abnormal condition. The important clinical signs and symptoms based upon a sound knowledge of pathology, anatomy and physiology will be missed. Understanding of the pathological processes producing the signs and symptoms and of their treatment with drugs of known pharmacology forms the boundary line which differentiates a medical graduate from a quack. I have no hesitation in advocating the maximum stress on the basic sciences of anatomy, physiology, pharmacology, biochemistry and pathology. These form the basis over which clinical practice is built up. How can one expect to start a building without a base? Such is the importance of these branches of medical sciences to me.

Now I take up the real problem of teaching these sciences at postgraduate level in ophthalmology. This problem is to be considered from two points of view. The level of the knowledge of a teacher in respect of these basic sciences is a matter quite apart from how much of knowledge he should impart to the students. It is a desire of many a teacher that his pupil should know everything. But the duration of postgraduate course is limited to three years which is rather short. And out of these three years one is spent in house job and another in working for the thesis. The student is thus left with only eight months to prepare for his examination. It is evident that, even if a postgraduate be expected to work to his maximum, it would not be possible for him to imbibe all the existing knowledge during this period. Therefore, it is essential that a certain standard must be laid down in respect of the basic sciences as well as of the main subject which should be adopted uniformly all over the country. This will mean a pruning of many superfluous details, leaving sufficient time to master the more important and useful aspects of the subject.

Starting with anatomy and physiology, their study at the postgraduate level should be thorough. The student must possess a complete knowledge of anatomy and its normal functioning. Anatomy and physiology are integrated subjects. The student must know all their important and applied aspects. To anatomy is also attached another very important branch of study, i.e. embryology; development of the eye, both normal and abnormal, should be known to a postgraduate in detail. It goes without saying that knowledge of genetics is an inseparable part of this teaching. Without laying much stress on minute details, the teacher should see that his students know about the application of this knowledge to diseases. Hence

As regards the thesis or dissertation submitted by the candidates, some discretion is necessary for the same. In many instances the work submitted is voluminous, being a copy of unnecessary exhaustive details from textbooks of historical, anatomical and other backgrounds of the subject. All these are utterly unrelated to the work to be presented, and as such difficult for the examiner to peruse. It should be a critical study of a selected number of cases viewed from all aspects containing investigation and presentation of results and conclusions.

As for the written test, the candidates may be asked to illustrate their answers with the help of diagrams wherever possible, as this practice is most useful for those who become teachers later on. The performance of a candidate in the written tests should be considered as a whole rather than in individual papers. More important are the practical and clinical parts of the examination for the assessment of candidates. The methods of examining and the way the candidate handles a case are worth noting. It is not the diagnosis given by the candidate that is important, because quite often he knows it, but the way he builds it up. One need hardly stress the necessity on the part of the examiner to have examined the case thoroughly himself. Cases of systemic and nervous diseases having ocular manifestations should be always included, especially for the degree examination. The candidate should also be examined as regards his familiarity with the practical handling of the various eye instruments and appliances as demonstrated by the cases given to him.

Above all, the standard for different examining bodies and universities should be uniform for the same examination. This calls for some form of a control by a central examining board. This board may have its own panel of experienced professors and examiners in the subject for appointment as examiners or inspectors. This measure, besides establishing the essential uniformity of standards, is bound to enhance the prestige of such postgraduate qualifications and bring forth a better class of specialists and teachers.

the student so that he can appreciate the rationale of medical treatment and be in position to modify the same on his own initiative as and when necessary An idea of biochemistry should be given to the student

In addition to the above suggestions, I should like to stress the importance of the attitude of the teacher towards the basic sciences. During all his talks and discussions, whether in the class room or on the bedside, while operating or prescribing a line of treatment after arriving at a diagnosis it is necessary that he lays due emphasis on the applied aspect of anatomy, physiology, pathology and pharmacology in respect of the particular disease under discussion This will inculcate in the student the habit of rational thinking which is the most powerful weapon in the armoury of a successful clinician and surgeon

aod other facilities It should have separate sections of ocular pathology (including a museum) and orthoptics The department of ophthalmology should be a separate department and not a part of the department of surgery or E N T

A sound training in the basic sciences and their applied aspects is essential The basic sciences training should be in the form of seminars by the members of the basic sciences department in collaboration with the ophthalmologists and other clinicians in order to make the approach multidisciplinary Pathology should form an important part of the course and it should be taught by ocular pathologists The basic science course in pathology should involve practical training It should be a continuing process in the wards and in the O P D during the clinical training programme Emphasis should also be placed on the study of genetics and statistics

The training in ophthalmology should be through seminars, journal clubs, symposia and clinico pathological conferences Didactic lectures should be limited In the diploma course, methodology of examination and investigations of patients should be stressed Clinical training for M S candidates should be through increasing responsibility for patients and learning of operative techniques Speciality clinics should be conducted whenever necessary The training for M S should be entirely an in service training programme

The thesis should form an essential part of the assessment in the Master s degree, Ph D and D Sc examinations The thesis should be submitted and accepted before a candidate is allowed to proceed for the examinations It should be a subject for questioning during the oral examination In preparing the thesis the student should himself carry out the investigations and experiments For the Ph D and D Sc degrees the thesis should be of a higher standard

ASSESSMENT

Before a candidate is allowed to appear for the final examination, he should be subjected to a continuous internal assessment and the head of the department should certify his satisfactory performance The assessment should be in all the three branches theoretical, practical and clinical Care should be exercised in the selection of examiners and inspectors so that only experienced teachers of high repute are selected for this assignment. The uniformity of the standards should be maintained and the Indian Medical Council or any other regulating body should exercise more vigilance in this direction The examiners should have the authority to refer back a candidate for a period of time not more than two years, if his performance at the examination is very poor

CONTINUATION IN MEDICAL EDUCATION

Refresher courses both for general practitioners and postgraduates should be arranged. Extension lectures and national and international symposia should be arranged Clinico pathological seminars should be regularly held Short tour programmes for the teachers within and outside the country should be arranged to improve the standard Courses should also be instituted for nurses for post basic training in ophthalmic nursing including theatre management. A training programme emphasising ophthalmology should be arranged for para medical personnel and technicians

REPORT OF THE SUB-COMMITTEE ON OPHTHALMOLOGY

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TO combat the high incidence of blindness and various types of eye diseases, a fundamental knowledge of the many aspects of ophthalmology is necessary not only for ophthalmologists but also for general practitioners. As such, a sound course in ophthalmic science is essential. Postgraduate education in ophthalmology should be built on the strong foundations laid during the undergraduate study.

SELECTION OF POSTGRADUATE STUDENTS

Selection of candidates should be made by a postgraduate committee of the faculty of the university. The committee should select candidates on the basis of merit. Their aptitude, performance in various professional examinations and responsibility for patient care should be given adequate importance.

POSTGRADUATE COURSE

The postgraduate course should be conducted at three different levels: the diploma, the Master's and the research degrees.

The general practitioners with some special interest in ophthalmology should register for the diploma course (D.O.M.S.). Duration should be for two years after registration. The candidate should have spent six months as a house-surgeon in ophthalmology. The course should be full-time.

The Master's degree (M.S.) should enable the student to teach ophthalmology. Students should be accepted for the Master's degree after one year of post-registration house-surgeoncy of which at least six months should have been in ophthalmology. The course should be full-time for three years after full registration. One unit should not be allowed to take more than six Master's degrees and twelve diploma students.

The third level of postgraduate study is the research degree, the Ph.D. and D.Sc. Candidates should be required to work for their Ph.D. two years after M.S. and for D.Sc. two years after the Ph.D.

INSTITUTIONAL REQUIREMENTS AND TRAINING

In order to start the postgraduate course an institution should have had prior recognition by the Medical Council of India with regard to staff, equipment, space, departmental library

The selection of postgraduates needs careful consideration. There is a good percentage of waste, and some of the postgraduates who take admission are not interested in the subject. They are on the lookout for something better and leave halfway, thus depriving someone else of a seat. Some take part-time jobs in other departments, others secure research appointments for a stipend. The result is the same: they miss a good deal of clinical work. Hence the attendance of these students should be considered. All postgraduates should be given responsibilities which should increase with their seniority and experience. These responsibilities should be such that they are kept attached to their department all the time or to an allied department interrelated to the studies.

All postgraduates, particularly those who are intending to be teachers, should be familiar with the everyday laboratory and minor procedures. Skill in these can be acquired only by carrying out all the techniques personally and repeatedly. The extent to which new and improved methods are pressed in everyday routine is a yardstick of the quality of the institution. How much can be done and should be done are for you to discuss.

The assessment of the postgraduate needs thorough revision. The present system is unsatisfactory; it does not give a fair test. Today the student is worried only about passing the examination. Curious and shocking are some of the methods employed by some of them to do so. We teachers have to accept a big share of the blame. I submit we should change the outlook of the postgraduate student. We should impress on him that he has come to the institution to acquire knowledge and he will certainly receive his degree when he has accumulated a certain level of knowledge. His progressive acquisition of knowledge should be tested periodically. The manner in which he discharges the responsibilities assigned to him should be the basic test. The final examination should be only a parting token of approval of one who has been making good progress all the time.

The equipment for a postgraduate department is of two kinds: material and personnel. You may consider whether in the present state of our country it would not be more expedient to restrict postgraduate teaching to a few institutions which can be equipped fully with material and personnel to do advanced work. This may avoid waste and overlapping. There is a swing towards full-time teaching staff. Are the present service conditions conducive to contentment and attractive to talent?

These are some points; there are many others and I have no intention of forestalling or anticipating your views. Let us today consider our present condition dispassionately. If it is satisfactory, all is well and good. If it is defective, let us not hesitate to shine the torch on it and put up suggestions for how to improve it. There are no sanctions behind this conference, but these sanctions we carry with us. If we are agreed today we can launch out and advance pediatrics in our country, which is our cherished objective.

OPENING REMARKS

DR. G. COELHO

IT is a great pleasure to assemble at this meeting for discussing a problem in pediatric education that is engaging our attention. I am thankful to the Association for giving us this opportunity. Prof. Chandy who is the Chairman for the Clinical Subjects has allotted to me the responsibility of chairing the pediatric discussion. May I appeal for your co-operation in this task, so that at the end of the day we may have done some constructive work. I am fortunate to have Professor Pohowalla as the rapporteur and, I am sure, he will convey to the general session the gist of our discussion with precision.

As you will have noticed from the programme of the conference, the organisers have provided a general discussion on the principles of postgraduate medical education first, to be followed by a consideration of the application of these principles to each subject of the curriculum. We have completed the first part and have now met for the second. As this assembly is limited to teachers in the discipline I expect all that is said will be based on first hand knowledge.

In my letter as general chairman thanking you for accepting the assignment made by Dr. Chandy, I had put out a suggestion that your contribution should be limited to conditions in our country as they obtain at present and to suggestions as to how we can improve them with the resources at our disposal. The task of preparing the papers has been limited to a few, all of whom have been requested to be brief in their exposition. This is because we feel that all those who will take the trouble to attend this meeting would do so because they have a positive contribution to make. We are here to receive as many of these as possible, discuss and assess them. Instead of imposing a time limit from the Chair, may I request you to impose one yourself. Further, kindly avoid repeating a point that has been made by a previous speaker.

We are to consider the equipment of a postgraduate department, qualifications of a postgraduate teacher, selection of the postgraduate student, content of the postgraduate teaching, the methods of assessment, the amount of research a postgraduate student should do. These are not new problems; they have been discussed before. Yet, it is only by constantly reviewing our progress that we can make progress and that is the justification for having such conferences.

There is an increase of interest in pediatrics. The applicants for postgraduate work in this department are nearly as many as in the discipline of general medicine. The existence of postgraduate qualifications having different standards confuse the organisation of teaching when, as at present, the number of beds, laboratory facilities and above all teaching personnel are so limited.

course. Others give a variable credit to those who have already done the D.C.H. and have additional experience as a resident exceeding the compulsory one year. Many universities restrict the admission to their own graduates while a few conduct an open selection with or without a limited reservation for their 'own' candidates. The number of seats at each centre varies from 4 per year to 12—this does not seem to be related to the size of the department or the staff. Where there are more than one participant colleges/hospitals for a programme, the total number may exceed 12 and there is some discretion with the teacher to admit one or more students. The selection is usually done with the recommendation of the supervisor but in some universities a board of selection is formed where the teacher/s may not be represented and such a board admits the students to all the postgraduate courses of that university which obviously results in some flexibility of the criteria. Some universities insist that every candidate desiring to be admitted to medicine or pediatrics M.D. should have obtained at least 60% marks in medicine

Recommendations

It will be observed that there is a variation in the criteria; in the number of seats available with each professorial department of pediatrics; in the method of evaluation for admission; in the credit for D.C.H. or the period of residency work in pediatrics. It is felt that, if the following suggestions are generally adopted, a more uniform pattern of admission will be possible.

(a) Until a better method of assessing a candidate's ability is found, the percentage of marks obtained at the various professional examinations should form the basis of the competitive selection. We must not consider the results of the final examination only, the average percentage should be worked out to two degrees beyond decimal at all the professional examinations taken. If a candidate has taken more than two chances at any of these, he should not be eligible for admission and for every additional chance taken 3% marks should be deducted from the percentage of that particular professional examination. This method would enable us to judge the over-all performance of the candidate throughout his undergraduate medical training.

Example A.

	Professional examinations			
	1st	2nd	Final	Total
Initial Assessment	62.83	60.84	61.22	184.89
	II chance	II chance		
Final Assessment	62.83	57.84	58.22	178.89
	Average %			59.6%

(b) Some ways of giving credit for a well-performed house job would be needed. There will always be some candidates who turn out to be devoted residents, though their results in the examination are not satisfactory. It is also likely that pediatrics turns out to be the subject of

METHODS OF SELECTION AND REQUIREMENTS OF POSTGRADUATE STUDENTS

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IN India today there are eighty medical colleges under the jurisdiction of 46 universities. To these are admitted 11,000 students annually and 5,000 to 6,000 are declared qualified as M.B.B.S. every year. Most of the colleges have two examinations a year, annual and supplementary, whilst a few have an additional third. Thirteen universities offer doctorate in medicine (pediatrics) and nineteen, diploma in child health, and two offer D. Ped. (diploma in pediatrics). There are a few (not more than three) which offer M D. in medicine with pediatrics as a special subject. Thus there may be 16 universities offering an M.D. in pediatrics or an M.D. with emphasis on medicine.

M.D.

By and large the pre-requisites for admission to the M.D. course are:

(a) M.B.B.S. of a recognised Indian University and completion of the pre-registration internship (varies from 6 months to a year).

(b) Training as a house officer in a recognised teaching hospital for one year, out of which at least six months must be in pediatrics.

Most of the admitting colleges (universities) admit students to the M.D. course, once a year, usually coinciding with the time of the annual M.B.B S. examination, while a few have admission twice a year following the annual and supplementary M.B.B.S. examinations. Each student has to undergo training for two years, at the end of which he is eligible for taking the examination, provided his thesis or dissertation has been approved by a board of examiners. Ordinarily within 3 to 6 months of admission the candidate gets the subject of his thesis/dissertation approved by the university, collects data on the proposed problem for 6 to 12 months and presents 3 copies to the University for evaluation, usually 3 to 6 months prior to the commencement of the examination. The thesis/dissertation is sent to the examiners and after approval the candidate is eligible for taking the examination.

Criteria For Admission

Most admissions take place on the basis of percentage of marks obtained in the final M.B.B S. examination, provided the candidate has completed the period of one year's satisfactory house job. Some universities consider the marks obtained at the preceding professional examinations and take an average percentage of all the examinations during the M.B.B.S.

(2) Candidates should be full-time residents in one department except when they attend joint teaching exercises where there are more admitting departments. But this should not interfere with their obligations in the parent department.

(3) They should be given graded responsibility for the care of patients—both in the ward and in the outpatients.

(4) A fellowship for the period of training of the value of Rs. 200 should be instituted.

(5) Suitable hostel accommodation or accommodation near the hospital which would help the students to attend to their duties without undue waste of time and expense in transport.

(6) All departments should have departmental libraries so as to encourage the habit of reading.

(7) Each department should have its own laboratory with adequate facilities where postgraduates must work with their own hands and only such data should be permitted as could be mainly employed for thesis work.

(8) There are in some centres full-time employees of the department who wish to do M.D. in order to better their prospects. Since their obligations of service do not allow them as much free time for pursuit of postgraduate studies as to those who are whole-time students, it is suggested that the former may be required to spend 3 years of training rather than two. This would apply to department registrars, junior lecturers, research officers, I.C.M.R. fellows, pool officers of the C.S.I.R., etc. If, however, they have already had this additional one-year training elsewhere in a recognised pediatric department, this condition of 3 years may not be applied and the period may be only two years.

(9) All M.D. students throughout the 2/3 years must not be engaged in any work, such as part-time jobs or private practice, other than duties allotted to them in the department where they are posted. In other words, they must be full-time postgraduates and participate in full in the department's teaching activities.

their choice and they do a commendable job. If he is so good and the supervisor likes him, he should be competent to give a credit up to 3% for the period of house job if it is one year and up to 1.5% if it is 6 months.

There is another way of looking at this problem. Why do we not admit candidates at the house job level and keep them to the department for 1 year, i.e. 1 year of house job and 2 years of post-house job residency? It would be in the fitness of things to admit some proportion of the number permitted at the level of house job, for this offers a better opportunity for a longer and better phased programme of residency and we may be able to give credit for excellence of performance rather than to the requisite content.

(c) A candidate who has passed D.C.H., M.D./M.R.C.P. (not in pediatrics) may be or may not be fit for further training. Although I would discuss the D.C.H. later, for comparative purposes one may give credit up to 3% for D.C.H. while calculating the total marks.

(d) There should be an additional method of judgment—that of an interview. An interview can be of 'individual' and/or of group type. While the former gives the assessor an idea of the candidate's ready wit and clarity of expression, the latter brings out the debating and discriminatory skill. For instance, a problem may be posed to a group of students eligible for admission, and in the presence of teacher/s each one in the group should be encouraged to participate. Some tangible impression can thus be formed. There is bound to be some criticism of this method since there is some subjective element in the method of interviewing but I am convinced that personal impressions of discussion across the table or in an informal group would be a great advantage in the selection of a candidate. Up to 3% marks may be reserved for the interview. But it may not be essential to send for all applicants. By initial pruning on the basis of average marks, etc. only a number twice the number of seats should be sent for, for an interview test. It should not be lost sight of that this method is in vogue in nearly all the competitive posts in the Public Service Commissions, etc. and has been judged to be profitable within limitations.

(e) Admissions should be done on the recommendation of the head of the department where there is only one admitting unit or heads of all the admitting units where there are a number of these. The University can see that the general principles outlined above are observed.

(f) There seems to be little justification for the rule of 60% in medicine as a prerequisite for admission. This should be discarded.

(g) The system of M.D. (medicine) with pediatrics as a special subject should be abandoned in favour of M.D. in pediatrics since the former makes you neither a physician nor a pediatrician.

Requirements

In order to have a reasonably good training, sound knowledge and independent thinking, ability to participate in teaching and research programmes, the following are necessary:

(1) Examinations and admissions should be held twice a year in January and July or follow within 15 days of the termination of the house appointment system.

DURATION AND CONTENTS OF COURSE

S. S. MANCHANDA, M.D., F.R.C.P., D.C.H., F.A.M.S., F.C.M.S.

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THE current phasing of medical education can be viewed as (1) *Undergraduation*—4½ years after premedical. (2) *Graduation*—(a) 6 months rotatory internship; (b) 6 months-12 months rotatory or selective house job. (3) *Postgraduation.* Before discussing the duration and the content of course in respect of postgraduate education in pediatrics, it may be useful to define the two terms, namely, pediatrics and postgraduate.:

Pediatrics—Its Scope and Frontiers

W. S. Graig,[1] rightly emphasises that the greatest handicap in the subject is its name. Pediatrics is still regarded by some as synonymous with diseases and therapeutics of infancy notwithstanding the fact that the scope of pediatrics extends far beyond the age of infancy and the realms of therapeutics. Pediatrics is, and must be, taken as general medicine, comprehensive in composition, dealing with the total individual. Thus it embraces all aspects of the ever-growing child, both in health and in disease. It is not an organ or system speciality. In the making of a pediatrician specialist, therefore, the training must concentrate on the whole child, not only confined to the treatment of a few diseases but aiming at the promotion of health and prevention of illness. The future specialist should, therefore, have proper understanding of the antenatal environment, the newborn, the full-term and the premature child, of genetics, nutrition, growth and development, biostatistics, social and preventive aspects, as also the psychological aspects, in addition to essential fundamental and applied knowledge of the basic sciences and organ-cum-system specialities. In the pursuit of knowledge, the student has not merely to concentrate on the hospital material—both out-patients and in-patients—but he should also participate in the domiciliary, clinical, and field programmes of a preventive nature.

Shortcomings of the Present-day Pediatric Teaching

The training of the undergraduate students continues to be dominantly "adult oriented." To quote Dr. Marij Avcin, "medical study usually begins with the adult. The student in the dissecting rooms begins with an adult cadaver and, in his training at the bedside, it is generally the adult patient whom he sees. Seldom does the body of a child come to the necropsy table." No wonder, therefore, the student unconsciously comes to believe that anatomy, physiology and biochemistry are concerned only with the fully developed organism. The child is thought of only in comparison to an adult, a pocket edition of an adult or a miniature adult and not, as reality demands, an individual in his own right with his own distinctive characteristics. With such an attitude well established in his mind, the student is initiated into the subject of pediatrics. There is then the added handicap, the time devoted to pediatrics in undergraduate teaching

(b) It may be desirable and preferable to take students who have had 6 months of house job in pediatrics but this should not be compulsory since all medical colleges do not offer facilities for such a training.

(c) There should be a resident posting in one hospital though students may attend common seminars, etc.

(d) At least 50% of the candidates should be given fellowships of the value of Rs. 200 per month.

(e) Examination should be at the end of the year and not after 9 months as at one centre. Even if a candidate fails and takes up appointment elsewhere, he can take the examination at the next chance. He need not take a long leave of 3 to 4 months but only for a few days to 3 weeks, thus avoiding interruption in his/her service.

(f) Examinations and admissions should be held twice a year to permit a regular cycle of entrants and exits corresponding to the M.B.B.S. examinations. This will reduce the unnecessary loss of time to those who complete the M.B.B.S. at the supplementary examination. Most of the universities hold M.B.B.S. in April/May and in Sept./Oct. Thus admissions and examinations for M.D./D.C.H. may be held by 15th Dec. and 15th June for courses commencing on 1st January and 1st July and examinations in the first week of January and July respectively.

(g) The selection and placement of candidates should be made by a committee of heads of the participating units.

DURATION AND CONTENTS OF COURSE

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THE current phasing of medical education can be viewed as (1) *Undergraduation*—4½ years after premedical. (2) *Graduation*—(a) 6 months rotatory internship; (b) 6 months-12 months rotatory or selective house job. (3) *Postgraduation*. Before discussing the duration and the content of course in respect of postgraduate education in pediatrics, it may be useful to define the two terms, namely, pediatrics and postgraduate.

Pediatrics—Its Scope and Frontiers

W. S. Graig,[1] rightly emphasises that the greatest handicap in the subject is its name. Pediatrics is still regarded by some as synonymous with diseases and therapeutics of infancy notwithstanding the fact that the scope of pediatrics extends far beyond the age of infancy and the realms of therapeutics. Pediatrics is, and must be, taken as general medicine, comprehensive in composition, dealing with the total individual. Thus it embraces all aspects of the ever-growing child, both in health and in disease. It is not an organ or system speciality. In the making of a pediatrician specialist, therefore, the training must concentrate on the whole child, not only confined to the treatment of a few diseases but aiming at the promotion of health and prevention of illness. The future specialist should, therefore, have proper understanding of the antenatal environment, the newborn, the full-term and the premature child, of genetics, nutrition, growth and development, biostatistics, social and preventive aspects, as also the psychological aspects, in addition to essential fundamental and applied knowledge of the basic sciences and organ-cum-system specialities. In the pursuit of knowledge, the student has not merely to concentrate on the hospital material—both out-patients and in-patients—but he should also participate in the domiciliary, clinical, and field programmes of a preventive nature.

is too short—1 or 1½ months out of 4½ years—and the period of training too is discontinuous. Furthermore, the non-inclusion of pediatrics as one of the major subjects in the final examination makes the student indifferent to the subject. The consequences of the erroneous practice, step-motherly treatment given to pediatrics, certainly does not provide adequate training in pediatrics during the undergraduate teaching.

Postgraduate Training Courses in Pediatrics

These include:

(1) Refresher or re-orientation course for general practitioners—for a minimum period of 2 weeks as full-time attendance, with no formal certificate or assessment at the end of the course. The general practitioner should be encouraged to join these courses once every 3 to 5 years. It should be a government undertaking.

(2) Diploma course with an examination (D.C.H.) after a one-year period of training comprising various aspects of child health and disease.

(3) *Doctorate in Medicine-Pediatrics* (*M.D.*). This is a specialist training and essentially differs from D.C.H. in its depth and breadth.

Objectives, Course and Duration

The chief objects of this highest national qualification are to provide properly qualified and trained teachers and consultants for the teaching institutions and upgraded district hospitals.

In the training programme, the emphasis should be on developing nature, understanding, critical approach and an aptitude for research among the trainees. The course and the training programme are not to be identified with interminable didactic lectures but must consist of responsible participation in the various spheres of hospital work, including teaching and research. The details of the courses, curriculum and examinations are likely to have minor variations. The essentials are direct experience in the care of the newborn under supervision, attendance at ante-and post-natal clinics, in-and out-patients, services and various promotional, preventive and supportive centres, insight into existing urban and rural conditions and visits to institutions for physically and mentally handicapped. A training period extending to no less than 3 years alone can claim to cover justifiably the depth and breadth of this course as outlined below:

(1) Basic medical sciences—Anatomy, Physiology, Biochemistry, Pharmacology, Pathology, Microbiology as applied to Pediatrics.
(2) Preventive Pediatrics—child welfare services and legislation, nutrition.
(3) Diseases of children.
(4) Pediatrics specialities, e.g. Surgery, Psychology, Neonatal Pediatrics, nutrition.

After graduation and after 6 months of rotatary internship, the M.D, training course should comprise a period of 4 years, including a period of one year as a house physician of which 6 months must be in the department of pediatrics and the remaining 6 months may be in the department of either adult medicine or pediatrics. Of the 3 years the first year should be devoted primarily to the writing of thesis/dissertation and study of applied aspects of the basic sciences and laboratory techniques. During the second year, the candidates must study pediatrics and

other allied clinical subjects, such as adult medicine, surgery, orthopaedics, various organ specialities, psychiatry, neonatal pediatrics and preventive and social medicine. The morning sessions can profitably be utilised in the specialities noted above and the evenings spent in the parent department. During the third year, the student should mostly devote himself to pediatrics both at in-and out-patient services. He should also participate at the various special clinics and centres such as the baby welfare and child guidance clinics and at the centres for the mentally retarded and other categories of the handicapped child.

The trainee for M.D. should be a whole-timer holding either an assignment in the department or having some other source of financial assistance such as stipends, fellowships from the state or central government or university. The in-service training on the continental pattern is to be preferred to the British formal course system.

Types of Institution

In addition to the trainees one must also look at the institutions that cater for postgraduation in our country. The facilities for this training are grossly inadequate and, in fact, rudimentary at present, in the majority of the 80-odd medical institutions in our country. The basic requirements are a well organised department of child health with a library, research facilities which should include such subjects as radiology, pathology and biochemistry sections, proper liaison with the department of social and preventive medicine and also with the basic department and other specialities. It is imperative that before an institution undertakes any such training programme, it must have the requisite optimal facilities and staff. In fact, some sort of a postgraduate co-ordinating body will serve a very useful purpose by reviewing and remedying the defects learnt from experience. Let there be only a few centres with adequate facilities for this type of postgraduation, then the temptation to produce numbers at the cost of quality will be strongly curbed.

The quality of the teacher is very important and is, in my opinion, the chief factor which determines the success and the quality of the postgraduates. Without giving an impression of rigidity in the matter of selection of the head of the department, I may remark that he must not be a person with only high qualifications but also experience in teaching and research. He must inspire and stimulate all those around him. The present status of the head of the department having no authority in the selection of his staff and without any funds at his disposal is highly demoralising. As regards the nature of his employment, whether full-time or part-time, salaried or honorary, this still remains a debatable issue. I am of the opinion that full-time appointment with a decent salary is conducive to the development of an attitude towards work and research for its own sake and as an end in itself.

Examination

The two present patterns of M.D. (Pediatrics) examination in vogue in our country are:

(1) M.D. (Pediatrics) such as at Bombay and All-India Institute of Medical Sciences, New Delhi.

(2) M.D. (General Medicine—a misleading term, implying Adult Medicine) with an elective, also called special, subject, such as haematology, dermatology, cardiology, chest diseases,

tropical medicine, endocrinology, urology, neurology, pediatrics, etc. It is an anachronism to relegate pediatrics to the status of an organ or system speciality. Pediatrics has assumed great dimensions, in view of the changing emphasis on the community and national needs, and international interest in various aspects of child welfare. *In fact it has a galaxy of its own sub-specialities.* As a digression, I may remark that "general medicine" may conveniently be split into three main age periods, namely, (1) General Medicine from birth to adolescence termed Pediatrics, (2) General Medicine of the adults, and (3) General Medicine of the aged, Geriatrics. The three consultants or physicians are all engaged in the practice and art of general medicine though of different age groups. To call them or one of them specialist is to create confusion. It is the organ *cum* system specialists who deserve to be "condemned or respected" as their field of study respects no age barriers. For example, a specialist in cardiology has not only to understand his subject but also to study the embryology, maturation and senescence of the normal and the abnormal and evolution of the function and structure of the cardiovascular system *all through the animal kingdom. I strongly feel that an M.D. in pediatrics should be* given training in pediatrics alone and not in a speciality or sub-speciality of general medicine as it happens in most of the universities (including the Punjab University) in our country.

I have dealt with the subject in its barest minimum. At the sectional seminar during the Silver Jubilee celebration of the Medical Council of India many relevant questions pertaining to the needs of postgraduation in pediatrics were discussed. It is not only against the background of that seminar but also by taking advantage of many discussions, formal and otherwise, in our own country and abroad on the subject that I have developed my views given above.

In conclusion, I confess that I have not suggested anything original or revolutionary. The repeated and prolonged deliberations over the last decade on this subject have invariably brought home to us the inadequacy of present-day pediatric training programmes. Almost similar suggestions for its improvement have not only been made but agreed upon in the past. The *status quo* nevertheless has persisted, not because of lack of deliberations, discussions or decisions on our part but because the authorities whose opinions matter, though they are well convinced, fight shy of change. In consequence, as thought without action is intellectual abortion, any decisions on the basis of these suggestions like those in the past, if unimplemented, are not even worth the paper on which these are written. We have deliberated and debated long enough, the need of the moment is for action. If we are convinced of the importance of Pediatrics why feel shy to give it the right charter.

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TRAINING OF POSTGRADUATES

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WHAT should be the aim of the curriculum and training? Is it to produce practical pediatricians who can be relied upon to diagnose common and less common pediatric ailments and handle emergencies and manage them by modern, up-to-date methods or is it to produce research workers who concentrate on a particular problem and often may not know much of the various aspects of practical pediatrics, pediatrics being such a vast field? In India, many universities which instituted M.D. in pediatrics have tried to combine both, but in my opinion based on the experience of examining M.D. pediatrics candidates and evaluating 'theses' for M.D. of various universities, I am afraid, consequent upon this effort to combine the two, both have suffered. To do full justice to a research project one has to concentrate on that for some years under a proper guide preferably drawn from among whole-time teachers. Also it needs several years of patient collection of data before they can be incorporated into a thesis. On the other hand, from what I have seen in the several theses that I have had to evaluate from the various universities in India, I am inclined to conclude that under the existing conditions the facilities and training in most places in India are such that a thesis in the true sense cannot be submitted by the best of the candidates in less than 3 years of intensive work on that particular subject.

Hastily collected data full of fallacies, inevitable in the present set-up, and sweeping assertions and conclusions based on such data where even the techniques used are often not subjected to critical scrutiny by the candidates, certainly present a sad state of affairs, since the very objective of a research thesis is defeated and the candidate, so to say, gets trained in wrong and objectionable methods. I suggest, therefore, instead of writing a thesis, the candidate should submit for the degree of M.D. a critical analysis of case records actually handled by him. This is now in vogue for M.D. pediatrics both in Madras and in Vellore (Madras University). Ph.D. is the suitable degree for submitting the thesis as some universities are beginning to do in India even in medical subjects, e.g. Madras.

Facets of Pediatrics

To acquire the training in practical pediatrics (not merely reading of books) requires several years of constant residency in a pediatric department which is employing modern methods, whether it be simple things like collection of urine or blood pressure of small infants or side room laboratory procedures or be it modern methods of therapy and investigations like exchange transfusion, air studies, bronchography in children, etc. Familiarity with all these requires several years of daily practical work in the department. Hence it is that both in Canada and in the U.S.A. no one is allowed to sit for the specialist examination until he has had several years (3 to 5 years) of residency job in a recognised, up-to-date pediatric department.

For a candidate to be familiar with these, the department, where he gets the training, should adopt these modern therapeutic and diagnostic procedures and the candidates must have sufficient time, at least a few years—unfettered by writing a thesis—to acquire practical working knowledge. Necessarily, only such centres as constantly employ modern practical methods in investigation and therapy of pediatric patients can be recognised for giving training. Some of these practical procedures are outlined below as examples.

Bronchography in children.
Air studies of brain.
Technique of barium enema studies in children.
Cysto-urethrogram studies.
Rough and quick method of C.S.F. sugar estimations in the side room.
Bleeding time and coagutation time and work-up of bleeding tendency in the ward side room.
Concentration methods for ova in stools.
Quick side room methods of finding excess fat, absence of tryptic activity in stool, sweat chloride test, etc.
Modern methods of taking B.P. in infants and children.
Modern methods of collecting urine in infants.
Routine otoscopic examination.
Methods of mummification and restraint of babies.
Techniques of taking blood from small infants (heel prick, jugular and femoral, etc.).
Exchange transfusion.
Methods of continuous drainage of air and pus in staphylococcal empyema.
Methods of giving O_2 humidification.
Simple side room methods for detection of foetal Hb. excess uribilinogen in urine, etc.
Osmotic *fragility—simple* screening test.
Coombs test.
Availability and frequent (almost daily) use of following consultants:
—E.N.T. for broncboscopy, etc
—Chest surgeon and cardiologist.
—Neurosurgeon.
—Dermatologist.
Resuscitation of newborn by laryngeal intubation in bad cases.
Postural drainage techniques in bronchiectasis and lung abscess.
Use of respirators.
I. V. fluid therapy by cut-down and scalp vein needle techniques.

Besides the above (which are just examples and perhaps only a minimum), there must be easy access (a) to biochemistry department for watching K, Na, C_1, CO_2, etc. done and for discussing reports with biochemists and (b) to bacteriology department for some familiarity with techniques of cultures and serology and discussion of reports. and (c) to pathology department for postmortems and biopsy studies. The presence or absence of such luxury items of investigations like paper electrophoresis or column chromotograpby should not be allowed to

overshadow the basic list given above. Only pediatric departments which have developed basic side room and other minimum facilities—both diagnostic and therapeutic—can be recognised as acceptable training centres.

Training in neonatal pediatrics and care of prematures is an essential part. This can only be done if such nurseries are well organised with modern techniques put into vogue and the pediatricians have a full say in the matter. Training in preventive pediatrics is another aspect which should receive adequate attention. Such training has to be organised by having a properly run clinic for children in the pediatric department, by having nutrition counselling classes for mothers and by having immunisation clinics in which the pediatric postgraduates can take active part.

By combining two or three departments in the same area and by a suitable exchange programme for the trainees even from different places one department can be made to supplement or make up what is lacking in that centre. Pediatric centres in Vellore and Madras have been following such an interchange of postgraduates for the past two years with mutual benefit to teachers and trainees. I must emphasise that if even a moderately up-to-date standard in this modern world is to be reached, it is not by examination, but by giving modern facilities in the chosen training centres, that we can achieve our aim. Otherwise the examiners would enable a student to pass without his having adequate working knowledge of these practical aspects. Standards have inevitably been lowered this way in India and the degree of M.D. in pediatrics has been awarded often where the standard of practical working knowledge of modern pediatric procedures is not even that of a house physician in pediatrics in Western countries.

Another aspect of training in pediatrics that needs to be emphasised is that the postgraduates at all levels must have clinical demonstrations and lectures on common surgical problems by the pediatric surgeon, if one such is available; otherwise by the pediatricians in consultation with the surgeons. They should also have such lecture demonstrations in pediatric dermatology, pediatric orthopaedics and pediatric ophthalmology by suitable persons. This needs reiteration because so often, for various reasons, these have been relegated into an insignificant role or omitted altogether in many centres even now. After all, the pediatrician has to deal with such problems in his day-to-day work. It is not always feasible to refer them to the orthopaedic specialist or the dermatologist. Nor is it realistic to do so in every case.

In conclusion, all aspects of pediatrics must be well organised and the training should be given by making the postgraduates participate in such activities.

TEACHING OF PATHOLOGY AND BASIC SCIENCES IN THE CURRICULUM OF PEDIATRICS

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IN order to assess effective ways of teaching pathology and basic sciences in pediatric curriculum it is necessary first to realise the mental approach of medical students to a particular subject or subjects. It is equally necessary to understand the mental approach of teachers to the same subjects. We are at present concerned with the teaching of pre-clinical and para-clinical subjects in pediatric curriculum. Therefore, we must first try to probe from what angle the students look at these subjects and how much importance do the teachers of these subjects give to applied teaching.

In teaching of any clinical discipline the place of basic sciences, pre-clinical and para-clinical subjects is unquestioned. In the case of disciplines like internal medicine, surgery or obstetrics, which mostly occupy the minds of clinical students, some stress is laid by the teachers of pre-clinical subjects during the period in medical curriculum when these subjects are taught. This study is referred to as applied anatomy, applied physiology, etc. However, even when such applied teaching is imparted, almost all the teachers think, talk, and teach in terms of an adult. Very occasionally the teacher of a basic subject in medical curriculum teaches something in relation to a child and that also when it is inevitable, as in case of certain congenital anomalies or congenital metabolic disorders. Even when a medical student is taught different subjects in the pre-clinical years, all they are taught is mostly in relation to adults. All this results in an approach by the students which is centred round the structures, functions and their derangements of adults only.

Not considering what may be happening in other countries, so far as our country is concerned, an overwhelming majority of pre-and para-clinical teachers all the time lay stress on their individual subjects in relation to mature adults. This may be so partly because through decades or perhaps centuries the study of these subjects has centred almost entirely round mature adults, and partly because of the phenomenal increase in the knowledge of medicine in the last few decades, which one finds difficult, if not impossible, to cope with. It is, therefore, not surprising that the teachers in these subjects are content to restrict their teaching, both basic and applied, to an unchanging phase in human life, namely, mature adult. Thus, even the teachers' outlook on applied teaching precludes the phenomenon of changing structures and functions in the growing period of the pediatric age group.

The next problem to consider in the teaching of these subjects is who is going to teach, the teacher of basic subjects or the clinician? There are a few institutions in the country where the teachers of the basic subjects show considerable interest in applied teaching in relation to pediatrics. But in most places they do not. Similarly several pediatricians take keen interest in imparting applied knowledge of these subjects in their teaching programme, but again, there are

It is helpful for the postgraduate to become conversant with these special interests, because they are thus introduced to the mode of thinking of these teachers, particularly when these special interests are a result of their research activities. Even if these special topics do not have a direct relationship to pediatrics, it is more helpful at postgraduate level to be introduced to these special problems than being taught basic facts of a particular chapter. It is not widely realised how necessary it is to create a correct, rational and critical approach to any subject in medical curriculum while teaching at postgraduate level.

However, it is necessary to give a broad outline of curriculum. Here are a few suggestions likely to be most useful to a pediatrician.

Anatomy

(1) Broad outline of embryology with special reference to those periods of intra-uterine development when noxious agencies are likely to cause deviation from the normal course of development.

(2) Congenital anomalies with special reference to their mode of production in terms of intra-uterine organ development.

(3) Genesis of skeletal formation; ossification; relative changes in sizes of bones at various stages of development.

(4) Gross systemic anatomy with special reference to differences in position, size, etc. of organs and structures at various ages of extra-uterine life, as compared to mature adults.

Physiology

(1) Neonatal Physiology (Differences in functions of various systems present in neonatal period as compared to functions in mature adults).
(2) Effect of prematurity on vital functions in the newborn.
(3) Nutrition. Special requirement of nutritional factors in relation to increased demands by the process of growth through infancy and childhood.
(4) Metabolism with special reference to growth and development.
(5) Endocrines. Functional variations during various phases of growth and development.
(6) Systemic Physiology as applied to growing organism.
(7) Genetics.

Biochemistry

(1) Bio-chemical norms at various ages.
(2) Difference in bio-chemical response to diseases of various systems as compared to mature adults.
(3) Bio-chemistry of inborn errors of metabolic disturbances during infancy and childhood.
(4) Chemical Pathology of metabolic disturbances during infancy and childhood.

Pharmacology

(1) Response to drugs at various stages during infancy and childhood.
(2) Pediatric dosages.

(3) Toxicity of drugs during pediatric age groups, specially in newborn period and in prematurity.

Pathology

(1) Pathology of the newborn (All systems in general and special pathological conditions occurring during newborn period).
(2) Hematological responses to disease during infancy and childhood.
(3) Neoplasms in infancy and childhood.
(4) Infectious diseases in infancy and childhood.
(5) Pathological changes secondary to developmental anomalies.
(6) *Immunological responses in pediatric age group.*

In conclusion, it may be stressed that in the teaching of pathology and basic sciences in the pediatric curriculum spoon-feeding must be avoided. This is true also of teaching in general of any subject at postgraduate level. If the teachers, singly or in combination, succeed in making the student study a subject or subjects of his choice critically, the aim of postgraduate teaching is achieved, irrespective of the quantum of knowledge the teacher might have imparted, or the students might have imbibed.

"THESIS OR DISSERTATION AS REQUIREMENT"

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THE word 'thesis' in the science of medicine usually means an exhaustive study of a problem from any one of the wide variety of angles like clinical, biochemical, bacteriological, radiological, etc. Usually in a thesis the candidate defines the aims and objects of his work, material and methods of study or a scheme of study which is then followed by an exhaustive review of the literature on the problem. Later he gives the results of his own study, discusses them and finally gives the summary and conclusions. The thesis ends with an extensive bibliography and often a summary of case records. The thesis usually runs into 150 to 200 pages.

A dissertation is written on a much smaller scale. It is usually a study of some selected cases. The review is limited to a few pages (not more than 4-6) only and it just touches the points relevant to the study, but no exhaustive theoretical and other details are given as in a thesis. Often the dissertation is a clinical study or an investigation important from the point of view of diagnosis and treatment of a disease.

Time taken for a thesis: A thesis is written with an idea to carry out an original study of a subject or a problem and hence naturally it needs much exhaustive study over a fairly long period of time. Often out of 2 to 3 years of training period for the course of M. D. degree the candidate spends almost 33 to 56% of his time for the thesis. He probably works hard, reads a lot and concentrates on the problem of his study to produce some original work but quite often it does not satisfy the high expectation either of the candidate or of the teacher. Anyhow, a voluminous work is produced, full of decorative charts, histograms, photographs, etc., which only qualifies the candidate to appear in the examination. The thesis serves no other purpose. Most of the examiners have hardly the time to go through these volumes, much less to evaluate them critically. Quite often the mistakes are glaring but the busy examiner does not go into the details to discover the cause of the mistake. He cuts short this botheration by simply avoiding critical evaluation, as usually he has to pass the thesis to please his colleagues. If at times he does critically evaluate, the other examiners still defeat this cautious and careful examiner by a majority of vote.

To avoid such an unpleasant situation, it is customary to say that the thesis is satisfactory. A majority of centres have got neither facilities, nor equipment, nor even adequate full-time staff to supervise the work Naturally the result is bound to be unsatisfactory and a good thesis is a rarity.

After going through a large number of such theses one feels that it is too much of a waste of time of the candidate to make an attempt to carry out such an exhaustive study of a problem over a period of a year or so which may be 33 to 50% of his total training period for the

doctorate degree, specially when hardly any special credit is given to the work in the evaluation of the candidate at the examination. If credit is given to a thesis of a high standard in the final examination and if the same is considered in the appointment of the candidate for a teaching post, the efforts and time spent on the thesis will prove worth while.

It should be added, however, that there are a few departments where the work is done under proper supervision; there facilities are fairly satisfactory and an intelligent, hard working, sincere, gifted student produces a delightful piece of work. But what is the result ? Quite often the student has produced an excellent thesis but because he has spent so much time and energy only on one aspect of a small or a special problem, he has little time left for his routine clinical laboratory, radiological and other training with the result that he presents a very poor picture in these aspects in the examination and goes down miserably. A fine research worker turns out to be a very poor doctor, which is as pitiable as an excellent clinician who may turn out to be a poor research worker.

That leads us to the basic question, the aims and objects of postgraduate training. The *following are some of the important basic aims:*

(1) To produce a specialist in the subject with the primary aim of providing good patient care or service to mankind. The specialist should be able to make an early diagnosis of the common conditions and implement proper management of the cases, specially the serious ones. He should have full knowledge of the common conditions to manage these cases in the best manner possible and some knowledge of the rare conditions in order to be able to detect them.

(2) To produce teachers in medicine. *This is important* as the specialists have *to teach in* a simple, easy and effective manner to the undergraduate students who are the future pillars of child care and health.

His teaching responsibility should slowly increase and ultimately he will have to be a postgraduate teacher. The qualities he has acquired during his basic training would go a long way to make him a good teacher in future. To achieve this aim, the teachers should carry out an intensive training of the cases in the ward, so as to emphasise the value of good history, physical examination, evaluation and significance of physical *signs, make a provisional diagnosis, to carry* out *important investigations to establish* the diagnosis and finally discuss all aspects of management—medical, surgical, psychological and preventive—keeping in mind the socio-economic, cultural, emotional and other environmental factors.

carry out work on the problems of child care and health in our country and upgrade the standards of teaching of the undergraduates, the future medical practitioners, and that of the postgraduates, the future teachers. However, the training should be for research mindedness and not for production of original research at the present stage and set-up in our country, We should see that the student does not get lost in some aspects of a problem and that too at the expense of his basic training as a specialist doctor. He should have a good all-round training in pediatrics, the most important being clinical and next in order being laboratory, bacteriological and biochemical, radiological and social and preventive pediatrics. It is possible that at the present stage and set-up a teacher may not be able to impart all the qualities of a good doctor, a teacher and a research worker to his postgraduate student but when the conditions in the country would improve and when we would have better facilities, equipment, staff and close co-ordination of various departments, then we shall be able to achieve these basic aims of postgraduate training.

Till that time let us devise our teaching programme in such a way that the clinical work is given the major attention, and at the same time train the student in research methodology by directing him to write a dissertation or a thesis. If one insists on a thesis, it should be given proper credit in the examination and the work should not be carried out at the expense of the other more important aspect of training which needs more time and greater emphasis today.

METHODS OF ASSESSMENT

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TO find out the methods of assessing the candidates in pediatrics we must answer the following: 1. What are the basic principles of assessment? 2. What are the existing methods in India? 3. What are the existing methods in scientifically advanced countries? 4. To what extent can these methods be implemented in our country? 5. What should be the recommendations for the assessment?

1. Basic principles

The basic aim of assessment of a postgraduate is to find out:

(i) To what extent he has grasped the knowledge.

(ii) To what extent he can implement his knowledge for better practice.

(iii) Whether he has qualified himself to be a suitable specialist in the field of pediatrics, possessing allround knowledge to provide a high grade of human service.

(iv) To what extent he has grasped the knowledge which will enable him to impart that knowledge to students.

(v) To what extent he is capable of participating in a basic and advanced research programme as adjudged from his dissertation and thesis which he has submitted for the examination.

Realising fully well that a candidate has got to be assessed from all these angles, the task of assessment becomes very difficult especially in the limited period of time at the disposal of the examiners.

properly. It would be ideal for the examiners to devote sufficient time for assessing the candidates, but in view of their heavy commitments both at their own institutions and because of the other important activities in the field of pediatrics, it becomes naturally very difficult for them to devote much time to assessment. Some of the centres have examinations twice a year which further adds to the difficulties in proper assessment. There is no uniform pattern of examination and there is a lot of divergence in the methods of assessment in the different universities. Consequently, it is very difficult to have a uniform standard of assessment. Some universities have general medicine examination both in theory and in practicals as part of the M.D. (Pediatrics) examination, whereas there are other universities which have only a paper in general medicine without any clinicals and practicals. Obviously, the assessment of a candidate who has got to do both general medicine and pediatrics has got to be of a different level from that of the candidate who is to be examined only in pediatrics. Usually, the assessment at a centre consists of examination of the dissertation or thesis, evaluation of the theory papers, clinical, oral and practical examinations. The evaluation of the thesis or dissertation is done in advance and on the basis of the examiners' report the candidate is allowed to appear in theoretical and clinical examinations. It is a debatable point as to what is expected of the candidate who has presented the dissertation or thesis. Generally, the candidates divide their dissertation into two parts: Part I, being the collection of theoretical material available from books and journals, thus appears to be a complete waste of time, since the candidates merely copy out the theory part and this takes away a good deal of their time. In part II, they discuss the problem, the investigations which they have done and the results which they have achieved. Very often they choose very simple problems. The present trend of assessment of dissertation is only to find out whether the candidates are capable of undertaking basic research and to assess their approach to research problems. It is felt that instead of dissertation being completed in a huge volume ranging from 150 to 200 pages, the whole thing could be presented in a smaller form. This conference could give a lead in eliminating the months of fruitless search which a candidate has got to put in for collection of material for part I, when the same time could be better utilised in the follow-up of the cases and better presentation of the investigations and results.

Regarding the theory paper, due importance is generally not given since the examiners just come for a day or two and they do not have sufficient time to evaluate the papers carefully. It is very often not possible for the university to send the papers in advance to the examiners partly because there is no time and partly because there is always the danger of papers being lost in transit. Therefore, the main assessment of a candidate is based on his performance in the clinical, oral and practical examinations. The clinical examination generally consists of a long case and two or three short cases and the time devoted for the assessment of the candidate depends on the total number of candidates on that particular day. If there are many candidates, the assessment has got to be made within a very limited period of time and if the candidates are only a few the examiner has an opportunity to assess the candidate more fully. Another difficulty often experienced by the examiners in assessment is that candidates who appear for the examination already seem to know the cases. There is no doubt that practically all the examiners attach a good deal of importance to the clinical examination. If a candidate

gives a very satisfactory performance in the clinical side, he is deemed to have a reasonable chance of passing the examination, and consequently he is not subject to a very arduous oral and practical examination. Those with poor clinical knowledge are automatically weeded out and those candidates who are on the border line take the maximum time of the examiners. The practical and oral examinations are generally devoted to asking the students to identify the X-rays, E.C.G.s; oral questions cover all the aspects of pediatrics. The time devoted to these is generally between 10 to 30 minutes.

The standard of assessment at the various universities is so variable that an impartial observer is very often amazed at the differences that exist. We have still not attained that degree of honesty and integrity to assess the candidates impartially, as it is so often felt by the external examiner that the internal examiner very often tries to influence examiners to get his favourite candidates pass the examination. This creates an adverse impression on the external examiners. In the present system of assessment these factors cannot be ignored as it is the internal examiner who frequently proposes the names of examiners and if the external examiners do not share his views they are ousted before their period of examinership is computed. I do not say this is applicable to a majority of universities but I am only trying to bring to notice the drawbacks in our present system of examination. It is therefore imperative that our system of examination has to be changed radically and a uniform pattern of assessment at the all-India level has to be attained in the evaluation of the dissertation or thesis and in the conduct of theoretical, clinical and practical examinations.

3, 4. The pattern which has been described above is what has been inherited partly from the British universities. Whereas the pattern there has changed radically we still continue to adopt the old pattern. One of the important considerations is whether the credit system should be introduced in our examinations. The credit system aims at giving recognition to the day-to-day work of the postgraduates in the clinical, oral and practical aspects. Due credit can be given to the presentation of clinical cases, participation in the conferences, in seminars, in clinical-pathological meetings and in journal clubs, and also to the ability of the candidate to teach the undergraduates and to discuss problems in his own group. If a candidate has shown credit in all these aspects of the work, and due recognition is given to him, it will stimulate the postgraduate to do better work. The main difficulty of the credit system at the moment is that we do not have adequate staff who could keep a complete record of all the activities of the postgraduates. The time spent by teachers in the institute is hardly enough to look after all the aspects of the students as well as to do the routine work of the hospital. Therefore, although this system is very good, it is very difficult to implement it on a practical basis. This could be kept in mind when our centres are developed more fully with a better staff.

The next question to consider is: Should we adopt the American system of multiple theoretical questions which assesses the candidate's knowledge in all aspects of pediatrics? This again involves a lot of time.

5. *Recommendations for assessment*

In conclusion, it is felt that the only way to assess the candidates properly in different

postgraduate examinations is to have an all-India body which should have a panel of names as examiners and to ensure that a uniform standard is maintained in all the universities. If it is not possible at this stage to have an all-India body to conduct the postgraduate examinations, it is suggested that the central body should appoint the panel of examiners, from which the examiners should be appointed. This body should work out the details of the methods of assessment which should be implemented at all the centres. It is only in this way that a uniform assessment can be carried out and the postgraduates who pass the examinations judged rightly.

POSTGRADUATE EDUCATION IN PREVENTIVE AND SOCIAL MEDICINE

DR. K. G. KOSHI

PREVENTIVE and social medicine is a new discipline that has been introduced as a discipline in medical education. This discipline has been introduced at the undergraduate level in place of traditional subjects like hygiene and public health due to the realisation that health and disease depend on multiple factors which have their origin in the physical, biological and socio-economic environmental forces in the community in which the individual lives. It is also realised that when dealing with a patient all the factors in the community which have an influence on health and disease should be studied, and that the physician should be responsible for providing both curative and preventive health services. It would therefore be appropriate to call this speciality as community health rather than preventive and social medicine.

The objective of the discipline at the undergraduate level is to impress on the undergraduate student the influence of various forces in the community on health and disease so that when he graduates he will be in a position to consider the community rather than the individual sick person as his patient.

At the postgraduate level the objectives are two-fold, namely, to train administrators to implement the health programmes of the country and to train teachers and research workers in community health. For training these two categories of specialists, two types of training programme are required, the first is of one-year duration leading to a diploma in public health and the second of two years duration leading to M.D. in community health. Both types of specialists should be well-versed in the problems of health in the country. Moreover they should have adequate clinical training to deal with them.

teaching. The department should have on its staff a social scientist, a public health engineer, a statistician and a health educator and should be able to get help from the departments of physiology, biochemistry, pathology, microbiology and clinical departments.

Minimum Requirements of the Training Centre

Accommodation in the College:

(1) Lecture Theatre ... One
(2) Seminar room ... One
(3) Laboratories
 (a) Microbiology and Entomology
 (b) Public Health Chemistry
 (c) Biostatistics
(4) Museum
(5) Staff room and Research room
(6) Library

Accommodation at the teaching hospital:

Seminar room for discussing case histories of selected cases.

Equipment:

(1) Laboratory: For routine public health chemistry, microbiology and entomology and a sufficient number of calculators for biostatistics.
(2) Teaching aids:
 (a) Epidiascope
 (b) 35 m.m. slide projector
 (c) 16 m.m. film projector
 (d) Health Education van fixed with microphone
 (e) Charts, Models, etc.
(3) Library
(4) Artist equipment
(5) Transport
(6) Films

Health Centres

A primary health centre should be attached to the department of preventive and social medicine. The health centre should be under the administrative control of the head of the department of preventive and social medicine and should have adequate staff.

An urban health centre providing comprehensive health servic s in an urban area should be under the administrative control of the professor of preventive and social medicine.

Methods of Selection and Requirements for Postgraduate Studies

The specialist in preventive and social medicine is responsible for planning and implementing

the health programme of the country as well as in training undergraduates and postgraduates in comprehensive health and in directing research in community health problems.

Efficiently to carry out this role, he must have certain basic qualities. He must have a dynamic personality and should have concern for people and their problems and he resourceful and tactful, so that he is able to understand the health needs and be able to plan out health programmes acceptable to the community. He should also have adequate clinical knowledge and competence to deal with the ordinary clinical problems he may meet with in his role as specialist in community health.

Students who have shown interest in their 3 months' posting in rural health work should he encouraged to specialise in community health. They may be taken as tutors in the department of community health and later taken for the postgraduate training.

Every effort should be made by the staff of the department of community health to encourage the best students to take up this speciality.

Candidates for admission to postgraduate training should have done one year of house-surgeoncy, spending 3 months each in medicine, pediatrics and obstetrics and gynaecology and 3 months in leprosy, venereal diseases or tuberculosis, thus getting an insight into the clinical problems and some experience in dealing with them.

Course of Study

In the postgraduate training, courses in basic sciences should be included to give a better understanding of the influence of various environmental factors on health and disease, and the changes that occur in the body under the influence of these factors which lead on to disease. The basic science course is also necessary for research work. But the organisation of such a course that would benefit the postgraduate trainees may not be possible with the limited number of teachers of the basic science departments. The only practical method that can be effective can he guided reading and discussion with the basic science teachers.

The training should aim at making the candidate an expert in community health. As an expert he will have to find out the physical, socio-economic, cultural and biological factors responsible for the health conditions in the community. The training should aim at making the candidate to investigate into these various factors. It should help him to draw valid conclusions and plan out programmes to meet these needs. For this it will be necessary for him to have courses in sociology, human ecology, psychology and biostatistics, in addition to the courses that are given for the postgraduate diploma courses in public health.

The postgraduate student should have also clinical experience to deal with the common clinical problems. Moreover he should know the pattern of work in health centres providing comprehensive health care, and know the services provided by various welfare organisations. He should also gain sufficient knowledge of the work of the public health department.

A minimum number of didactic lectures should be given. Instructions should he given by seminars, group discussion and guided reading and observation as well as by inservice training.

Dissertation or Thesis

The public health administrator should be able to analyse the public health problems, the various measures taken to control disease and promote health, and to submit periodic reports

to the administrative authorities. To enable him to get this training and to evaluate his skill it will be advantageous to include the submission of a dissertation on a topic concerning public health.

For the M.D. in community health programme for the training of teachers and research workers, it is necessary that during the training period they carry out a research programme under supervision of an experienced teacher and get a thorough training in research methodology, critical evaluation of data and presentation of conclusions in a lucid manner.

Assessment

Assessment or evaluation should be a continuous process beginning at the time of selection of the candidates for the postgraduate courses and carried throughout the training period up to the time of the final assessment made at the end of the course

At the time of selection the candidate's previous achievements, his personality and motivation should be assessed. During the training period the candidate should be assessed by the teachers regarding his attitude, ability, perseverance and his knowledge of the community health problems as well as the way he deals with these problems.

The assessment made by the teachers should be taken into consideration along with the marks scored by the candidate in the examination given at the end of the course.

Diploma in Public Health

This course is designed to train physicians for an administrative position in the public health department The course will be of one year duration at the end of which the qualifying examination will be given.

Course of Study

During the first three months an intensive course in sociology, human ecology, social anthropology, social psychology, history of public health and biostatistics should be given

Later, the students should be given formal instructions in environmental sanitation, epidemiology, communicable diseases, entomology, microbiology, physiological hygiene, nutrition, vital statistics and various aspects of public health administration.

The student should work on a part-time basis in a rural and an urban health centre and also in an infectious diseases hospital as well as in the various sections of a public health department.

The students may be posted for inservice training in the morning while the formal instruction and seminars may be conducted in the afternoon.

The student should choose with the approval of his professor a subject in public health for writing a dissertation. This dissertation should be submitted before taking the final examination

At the end of the academic year the student will take a written, practical and oral examination and a clinical examination in communicable diseases

During the first year the candidate shall attend for a period of three months in each of the departments of medicine, pediatrics and obstetrics of an approved institution and three months in a rural health centre and in urban health centre, in addition to taking courses for his diploma. In the case of candidates who have passed D.P.H., the candidates will do the above work in the early part of their course.

During the period of clinical training, joint socio-clinical conferences should be arranged in which the clinical teachers and teachers from the departments of preventive and social medicine will take part.

During the second year the candidate will undergo a course of study in the department of community health mainly in the form of seminars and group discussions.

They will also take part in the undergraduate training programme.

Each candidate will select a suitable field research programme under one of the teachers in the department early in the course and submit a thesis approved by the guide before taking the final examination.

Examination: Part I (at the end of first year) Medicine (Written)	I Paper	3 hours
Pediatrics and Obstetrics (Written)	I Paper	3 hours
Clinical and oral examination.		

Paper II: (at the end of second year)

Preventive and Social Medicine.	Paper I	3 hours
	Paper II	3 hours
An essay on a chosen public health subject.		
An oral examination in Preventive and Social Medicine.		

Thus the one-year programme will equip the trainee for administrative work and the two-year programme for teaching, research and senior administrative positions in the public health department.

At the postgraduate level also, the importance of integrating curative and preventive services for the successful implementation of the health programme should be adequately emphasised.

REQUIREMENTS FOR POSTGRADUATE STUDENTS

(1) The requirement for admission to D.P.H. course should be one year of compulsory pre-registration housemanship or internship. The course is of one year duration at the end of which the qualifying examination is taken.

(2) A candidate can register for the M.D. programme in preventive and social medicine after full registration (after completing the compulsory housemanship). The course is of three years' duration at the end of which examination is taken. Candidates with a public health diploma may be given credit of one year and their course will be of two years' duration.

(3) Candidates for registration for Ph.D./D. Phil./D.Sc. should have M.D. in preventive medicine or in an allied subject. They should engage in a research programme approved by a recognised guide for a period of two years for Ph.D./D. Phil. and for a period of 3 years for D.Sc.

SELECTION OF POSTGRADUATE STUDENTS

The criteria to be considered in the selection of candidates for postgraduate studies are basic qualification, motivation and orientation and experience in community health programme.

In the selection of the students for M.D. in preventive and social medicine, preference should be given to those possessing M.D. in allied subjects or diploma in public health, junior teachers in the department of preventive and social medicine (tutors, demonstrators) or those having experience of about three years in community health work or connected with the problems of community health in Armed Forces, Railways, etc.

Candidates for Ph. D /D. Phil./D.Sc. must be teachers and/or research workers who have been engaged in research programmes.

The candidates for postgraduate studies should be interviewed by a selection committee of senior teachers and research workers.

The basic qualification, previous experience and motivation should be assessed. In the case of Ph.D./D. Phil /D.Sc. candidates, previous research experience and papers published should also be taken into consideration.

No other postgraduate course involves the participation in so many disciplines as the postgraduate courses in preventive and social medicine.

In the M.D. programme the course should provide adequate opportunity for detailed study of various aspects of preventive and social medicine and practical knowledge of the administration of the community health programme in the State. Opportunities should be provided for taking part in the undergraduate training programme in addition to research.

The specific research work should however culminate in a presentation in a thesis form. This is an essential requirement, though it cannot be considered the only one. It has also the qualities of exposing the student to the methodology of defining and solving a problem.

In conclusion, it may be said that candidates with adequate clinical training and experience and understanding of the health problems of the country should be selected for postgraduate training.

METHODS OF TRAINING IN PREVENTIVE AND SOCIAL MEDICINE

(With Special Reference to the Postgraduate Education in India)

DR. N. S. DEODHAR, M.S., D.P.H., D.HY.

Professor of Preventive and Social Medicine, B. J. Medical College, Poona

A chief of the department of health education was once requested to loan a film on water. A medical officer of health needed it for implementing his programme for control of guineaworm infection. The chief was at a loss as he did not know the purpose in showing the film, nor the type of people to be exposed, the desired effect and the action the people were expected to take. Wisely, he just handed over a sterile knife to the medical officer and requested him to perform an operation on a patient waiting in the adjacent room. To cut the story short, what is true of the film and the knife is also true of the methods of training. Use of inappropriate methods of training will fail to achieve the goal of education. What are then the basic issues?

Basic Requirements

India is undergoing revolutionary developments in the field of health services. With the realisation that the objects of control and prevention of diseases and promotion of health cannot be accomplished by working on a narrow base, we have rightly taken the path of the community development programme. The practice of "public health" has to be dynamic and progressive. The problems of postgraduate medical education, especially in preventive and social medicine, are inseparably associated with those of practice and education. Scientific knowledge is progressing rapidly and the needs of the individuals and of the community are changing. New skills and abilities are required of a health worker. All these changes in the practices and requirements are bound to have a significant influence on the objectives, character and the methods of postgraduate training.

If this is so, our educational methods should be directed to train a postgraduate student not only in acquiring knowledge but, in addition, in equipping him to efficiently apply this knowledge in achieving the optimum health for the people under his care, in advising the State or local authorities on all questions connected with health and in implementing their health programme.

Medical science is progressing rapidly and to be professionally successful one must be conversant with the recent advances. Providing reading material or arranging refresher courses will not solve the problem. The educational methods should develop in students a keen desire to acquire further knowledge even after the qualifying examination. During the process of learning the period of postgraduate education enables one to qualify as a specialist, teacher or research worker. The educational sequence from the professional period to the retirement

should be a single spectrum and not a fragmented one. We learn through reading, hearing, observing, discussing and working. Appropriate training methods will help the students to cultivate habits of learning by creating in them *a sense of incompleteness.* This should be just enough to stimulate and not cause frustration.

Adequate emphasis on interdependence of the different fields of activities is very necessary. The training methods should point out the necessity of flexible and adaptable programmes, team work, and co-operation of and co-ordination with other agencies.

Artificial segregation of theory and practice may tend to create a serious gap in education. The changing patterns of public health and disease prevention programmes should not be ignored. To illustrate, it is necessary for the students to participate in and know the advanced procedures in clinical medicine for early diagnosis, treatment and rehabilitation. Unfortunately, the practical training is often limited to the public health laboratory work on the chemistry of air, food, water and sewage. This is totally unnecessary as a physician is never called upon to do this type of work.

Objectives of Training and Methods

The present teaching methods leave much to be desired. The objective of education is the acquisition of knowledge and acquiring an ability for its efficient and correct application. There are different ways of teaching in different countries in the world. So also within a country suitable methods may change with every generation as the needs and ideals of the society change.

Lectures

There is still a tendency among the medical educationalists to equate a good training programme with giving a course of lectures, with up-to-date factual information. Unfortunately, if such lecture courses form the core of training, there is nothing more damaging and destructive to the basic purpose of postgraduate training in preventive and social medicine. I have checked this on many occasions while examining both the undergraduate and postgraduate students. Sound concepts and understanding cannot be acquired by listening to lectures; they are to be acquired and mastered through suitable methods. Such methods are only occasionally used. Conventional demonstrations, visits and other methods of practical training can be more or less classified as *modified lectures,* and usually these are taken casually rather than seriously. In brief, the role of the lectures as a method in the postgraduate education should be limited to the *primary orientation* and *general introduction* to the subjects and the training programme. I wish to add that the teaching methods and techniques suitable for training of the undergraduate students are generally inadequate for the postgraduates. This is because of the radical difference between the approaches and the purposes of training of a basic doctor and of a specialist consultant.

Library Work and Group Discussions

These are the last methods to acquire knowledge. Library work is basic. The students should be guided in making the best use of the library facilities. In my experience most students are unable to use a library beyond reading some standard books because of lack of training in the methods of using the library. It is necessary to provide up-to-date text-books, current

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journals and a dependable reference service. Organised discussions among the students and the teacher is the best method to assimilate knowledge and to develop critical and balanced views. The quality of any dissertation submitted can perhaps be a good index for evaluating the success of these methods of training.

Field Work and Seminars

These provide the best scope and opportunity not only to acquire further knowledge, but also to apply, test and critically evaluate the same. Theory and practice should not be artificially separated. The comments as "this is more theoretical" indicate a failure of training and inability to adapt to the circumstances. Theory in health sciences has no value if it cannot be applied. The field practice should essentially give the student full and unrestricted opportunity to work and participate in all the activities which will make him a true exponent of preventive medicine and enable him to take up greater tasks The following are some of the important facets of practical training methods.

There is an increasing tendency to reduce the emphasis on the field practice in environmental sanitation. The more fortunate countries in the world may pursue such a policy. But poor sanitation is a major problem in India. It has an important bearing on the eradication of some of the important infectious diseases, particularly cholera, typhoid and dysentery. If a decision and expert opinion is demanded of a medical officer of health on the aspects of environmental sanitation for which he is held responsible, the training should include field work which will give him the necessary competence.

Training in epidemiology is apt to become unrealistic and spurious, if no laboratory and field work are provided. Study of a real problem, suitable planning, and proper evaluation and design of the appropriate measures even lead one to feel that these types of co-workers are the subordinates and thus one becomes incompetent to play the proper role in the team approach. As team work is very vital to the professional success of the future pracitioner and consultant in preventive and social medicine, it is clear how disastrous the effect of using improper training methods will be. The training can be further consolidated through interviews, counselling and home-visits to the patients jointly by the physician and other workers. This approach is found to be very effective.

It is needless to describe the other methods which are used, as they are essentially the same It may suffice to say that the students should be given practice in the art of interviewing, home-visiting and dispensary, diagnostic and clinical laboratory work. Adequate training in the modern developments in the clinical management of both the communicable and non-communicable diseases will enable the prospective custodian of the health of the people to widen the field of his activities as the circumstances may demand in future.

Apprenticeship and Residency

Both of these are invaluable methods of training, but not yet fully explored. The various fields where these can be effectively used are health administration, specialised services like maternal and child health, school health, industrial health, family planning, control programmes like those for small-pox, tuberculosis, leprosy, and the other urban and rural health activities.

The list is by no means complete and can be extended to include the problems of cripples, invalids, destitutes health education, laws and regulations and others.

What Can be Done

One of the problems will be the difficulty of tackling these problems in one year. But the circumstances demand much of the modern health officer and if he is to command respect and work successfully for the welfare of a community by employing the multifarious activities and programmes, thorough training is essential. It is, therefore, necessary to increase the period of training at least to 2 years. This will not only enable one to shoulder wider and varied responsibilities efficiently, but also bring the medical officer of health academically on par with the other consultants. Many institutions in India have already instituted a degree of Doctor of Medicine (Preventive and Social Medicine). If it is essential to turn out the specialist *rather quickly, we may do so through D.P.H. with specialisation in one branch* rather than produce a jack of all trades. The D.P.H. should be only used specifically in the speciality.

The available resources should be fully used. This is better than overloading the existing training institutes and making them inefficient. *Suitable fields for practical training are* available throughout the country. Some of these are well equipped and well staffed. Many others scattered all over the country remain unused for training. These can be immediately used as placements for apprenticeship, residency, etc. Provision of transport and proper planning is all that is necessary.

One learns as one sees. Unfortunately there are only a few ideal service centres. It is necessary to ensure that at least some service units are improved to serve as training centres. However, these should not be upgraded into so-called "demonstration areas" as these tend to give a false impression. All that may be necessary is to transfer a suitable medical officer to the unit. He should draw his personal pay and should be provided with adequate staff and equipment. *It is necessary also to establish medical social service departments in* all the teaching hospitals.

A sufficient number of teachers is not available. Capable and interested persons should be induced to take teaching posts by improving the service conditions and improving the facilities and equipment *required for them. The services of good teachers who are lost due to promotion* to a higher administrative post or made to retire because of age, should be fully utilised.

The administrators, local health officers and teachers should meet regularly. This will have two benefits. The early application of the newer methods and scientific advances will improve the quality of service and the local problems can be investigated and the students will be trained for the requirements of time, place and community.

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TEACHING OF PATHOLOGY AND BASIC SCIENCES

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THE title carries the implication that postgraduate education, like undergraduate education, must have a relation between its content and sequence. To the extent that the former is a direct continuation of the latter there would be similarities between the two curricula The scope would be extensive and its level should be of a higher order because of a character of specialisation that determines the postgraduate studies.

For purposes of this discussion, it is assumed that preventive medicine means clinical preventive medicine. It is further assumed that social medicine concerns itself with the systematic study of social forces and their dynamics in the initiation and perpetuation of morbidity through the techniques and perspectives of social sciences in medicine.

CONCEPTUAL FRAMEWORK

The study of human disease, defect or disorder involves the concept of natural history. Agents of disease and the host move towards a mutual confrontation under certain combinations of environmental forces. This is the phase of prepathogenesis. The following phase of pathogenesis is determined by host-agent relationships of varying magnitudes and outcome.

This conceptual framework of natural history provides the rationale for the modern preventive medicine, which is applicable at different points on the scale of the natural history of disease.

A. DISEASE AND INJURY

Among the important adaptations entailed with commencement of extra-uterine existence, response to infectious agent is a vital experience to the newborn. These encounters continue to pose challenges of varying intensities at different geographic locations of human populations. The nature of this phenomenon can be outlined by referring to selected problems in the study of microbes pathogenic to human host.

I. Patho-biology

Bacterial metabolism, including active and latent enzyme systems, establishes a pattern of survival for a number of organisms and their interaction with the human host. A relative shift has taken place from infections from strepto- and staphylo cocci to gram negative bacilli. The intestinal bacteria of relative insignificance like Aerobacter, Proteus, etc. are becoming frequent invaders of human blood stream. As against a measurable morbidity, the phenomenon of increasing inapparent infections needs to be understood in terms of its effects.

To gain insight into these phenomena an intelligent understanding of the fundamentals of bacterial metabolism, the influence of chemotherapeutic agents on bacterial flora and impact of corticosteroids on the course of infection is necessary.

In the realm of viral infections the distinctive problems are related to interference phenomenon pertaining to both homologous and heterologous viruses, and persistence of virus infections.

Where the viruses are arthropod-borne in their transmission, bionomics of the infection chain forms the basis of understanding. Of particular significance is the phenomenon of adaptation of the basic chain to a new host and/or new vector.

Patterns of response of the human host at cellular and humoral levels form an essential component of the agent-host relationship. Apart from specific immunity, knowledge of the properdin system is necessary to appreciate a wide range of defence it confers on the host. The carrier state is a specialised kind of balance between the agent and the host and it forms an important reservoir in channels of transmission

The study of bacteriophages is essential to gain understanding in the genetic alteration and pathogenicity of bacteria. So also is the study of antibiotic-induced resistent strains, e ge., quantitative trait of polygenes induced by Penicillin and single locus qualitative alteration brought about by streptomycin.

Infestations by animal parasites highlight the problems of complicated life cycles in definitive and intermediate hosts. This biological requirement of survival results in reproduction at a quantitative level geared to offset great chances of destruction of offspring through a failure to reach a new host.

The design of prevention and management of communicable diseases would become sound and efficient only if the specialists in the field acquire a firm foundation of knowledge of the salient characteristics of the microparasite and the cell pathology and defence mechanisms of the host. In order to emphasise the perspective of biology, it is proposed that this branch be designated as patho-biology.

2. *Radiation Biology*

Under the category of physical agents of disease ionising radiation constitutes a complex and serious challenge to the cellular integrity at a molecular level. Nuclear lesions are predominantly chromosomal and/or cytoplasmic being mitotic depending upon the dose and duration of radiation. The implications are in terms of mutation in case of damage of the former and neoplasia in case of the latter. The transformation of the nucleus into a radioresistent state takes place if it is freed of its cytoplasm.

The radioactive isotopes provide opportunities of precision in the study of metabolic processes or localised eradication of neoplasms.

Therefore, it is very essential in a nuclear age that the consultants in preventive medicine are intimately conversant with fundamentals of radiation biology—particulate and electromagnetic radiation, comparative radiosensitivity tissues and organs, nuclear fall-out, and radiation carcinogenesis. Finally the study of a possible protective role of reducing substances such as cysteine and glutathione is a right step forward in the direction of prevention of radiation injury.

of a significant proportion of individuals with defects compatible with life through lowering of death rate.

The defects, internal and external, have as their basis the environmental influence and genetic origin.

1. Human Genetics

The genetically determined defects or malformations may be of a nature of metabolic disorders, e.g. *diabetes, alkaptonuria.* They might be expressed as a trait of sickling of red blood cells or an absence of type such as Rh negative. The variation might even assume the form of differences in the rate of inactivation of drugs (e g. antitubercular) in the body.

These phenomena can be understood by an acquisition of basic knowledge in the fundamental aspects of genetics: single gene transmission of pathological genes, differential frequency of certain genetic traits in different populations, polymorphic systems determining multiple varieties of certain traits. The basis of natural selection needs to be appreciated through differential mortality and reproductivity. What is more, the selection can continue to operate through other channels when differential mortality and reproductivity are favourably influenced by human effort. Certain genetic patterns are not subject to the process of natural selection because they become operative in the post-reproductive stage of the life span, e g. cardiovascular diseases, chronic rheumatism

C. DISORDERS

The third major group is of nutritional and metabolic disorders. The former has a significance in the study of nutritional status of various groups in the population. The latter establishes an association of significance between an inborn error of metabolism and an observed clinical disorder.

1. Nutritional Physiopathology

The co-enzymatic action of various vitamins has a role in maintaining the vital chains of metabolism and thus assuring a normal range and level of tissue functions. The lesions that follow a lack of a particular micronutrient form the basis of identifying a deficiency disease.

It is very essential to know the sources of these vitamins in nature and the form in which they exist as pro-vitamins. By tracing the supply in food and the final fate of each vitamin one can understand the nature and scope of nutritional deficiencies: primary deficiency, conditioned deficiency, multiple deficiencies, etc. A correlation of lesions to functions provides precision in the study of deficiencies. A knowledge of methods of determining serum levels and observing response of excretion following 'Load Test' provides a quantitative basis of study and management of these deficiency states

Kwashiorkar and the fatty liver are challenges to understanding in the field of nutrition. A particular geographical distribution of these conditions and other diseases like cirrhosis and primary cancer of liver in the same regions raise a question of a casual connection or a common denominator.

Protein malnutrition and the role of lipotrophic substances give clues to an analysis of these problems. An insight into these problems can be gained through an understanding of the

metabolism of the methionine-choline group and the physiological effect of low protein and high carbohydrate intake on body growth.

2. Biochemistry

a. Haemopoisis

The problems posed by anaemias are that of (i) mixed aetiologies and (ii) refractoriness to haematinic principles.

Amongst the megaloblastic anaemias, pernicious anaemia is a classical feature studied intensively and yet its refractoriness to hog's stomach extracts needs explanation. Megaloblastic anaemia along with scurvy is an interesting combination during infancy. Macrocytic anaemias develop under a number of circumstances, e.g. macrocytic anaemia with a normal gastric mucosa but faulty B-12 absorption; macrocytic anaemia of pregnancy and many others. A basic knowledge of the metabolism of B-12, Folic acid and Vit C can aid in differentiating the relative contributions of these three principles.

Iron metabolism in respect of its storage, re-utilisation, daily requirements and a precariously balanced mechanism of absorption needs to be thoroughly understood. Particularly the implications of deficiency are of serious import during infancy and for women of childbearing age.

b. Metabolism: Maintenance and Disorders

The complex and multiple pathways of metabolism of various biochemical entities are controlled and their direction determined by substances synthesised by the adrenal cortex. The anabolic or catabolic level of protein metabolism is a function of corticosteroids. The role of the steroid cholesterol in various metabolic processes and/or disease production needs to be studied and understood. Despite the complexity and tentative positions in respect of the physiological functions of these steroids, a judicious acquaintance and general appreciation of basic mechanisms is essential.

The traditional metabolic disorder to be thoroughly studied is diabetes. The mechanisms like latent diabetes without impairing the intermediary stages of metabolism is kept on by an excessive secretion of insulin. The chronic overt stage may be expressed only by postparandial hyperglycemia. The foetal dysmaturity in diabetic mother is a problem of detection and obstetrical management.

Another important disorder of metabolism is an abnormally high excretion of cystine. This defect encompasses excretion of other amino acids such as lysine, argitine and ornithine. The clinical conditions closely associated with the high urinary excretion of these amino acids are recurrent urinary calculus formation, Wilson's Disease and Fanconi syndrome.

The studies of these selected amino acids serve as models for demonstrating the basic relation of metabolic disorder to a well defined morbidity.

D. MENTAL HEALTH AND DISORDERS

After considering the problems of pathological states on an organic level, a logical step will be to review the position in regard to mental health.

If homeostasis of the internal environment is an important adaptive mechanism, capacity to adapt to external milieu leads to protection of organism. This capacity is under the nervous control. In the event of development of brain, as in man, new adaptive responses are acquired or learnt in dealing with changes of external environment. The mode of behaviour of an individual is determined by his feelings and thoughts. The normalcy of feelings and thoughts and their variability are connected in turn with symbolic communication and interpersonal relationships.

Another dimension to mental disorders is the type of distribution of cases through geographic space and time. (a) Concentration of the highest rates of schizophrenic group in the most disorganised areas of the city (b) Unselective distribution of the manic-depressive group in areas both highly organised and disorganised. In addition, similar differential distribution is seen in the categories of catatonic and paranoid type of schizophrenics amongst the privileged and deprived economic groups.

If the problems of psychiatric disorders are to be unravelled from different angles, it needs an insight into theoretical formulations of certain selected disciplines of social sciences.

Such a basis would be provided if formal information is obtained in regard to culture, socialisation (moulding into the culture of the group) and social system.

This basic information should be able to demonstrate a functional system between the personality of an individual and the culture of a society.

The endeavour should encompass study of basic material from psychologies—general, experimental and social—cultural anthropology and human ecology.

SCOPE AND LEVEL OF STUDY

Having established the relevance of basic sciences to the body of knowledge of preventive and social medicine, the next step would be to consider as to how extensive and intensive this concern for basic sciences should be.

There are two points of view and one of them needs to be adopted unequivocally. The first one is that the quantum of knowledge acquired in basic sciences during the undergraduate phase is sufficient and attention may be focussed on subjects of direct concern. This viewpoint is assailed by critics who conclude that the trend of super-specialisation directly after graduation is a dangerous development. Super-specialisation, though penetrative, necessarily concerns a selected narrow field. Thus, the background knowledge of a super-specialist is not as extensive as that of a general specialist.

It is proposed that in order to eliminate this defect, a broadening of interest should be secured by inclusion of material from related disciplines. The term 'basic sciences' should be interpreted to mean 'foundational' sciences. This will resolve the problem of the pure versus applied. This will establish a kind of relativism, i.e. what is basic to preventive medicine in the field of microbiology and human genetics is not necessarily identical with what is basic to microbiology and genetics themselves. Thus, the relevance of the material is ensured and its foundational character is established.

The next point to decide is the level of understanding to be gained in the basic fields. It has to be necessarily more than what is acquired during the undergraduate phase. In the

latter case the knowledge is descriptive At the postgraduate level, it should be analytical-synthetic in form.

This high aim in training is being aspired to so that the products of the educational process *would be thoroughly equipped to play their role of teachers in preventive and social medicine*, a role which involves promoting an integrative perspective in medical practice and sharing academic ideas and research efforts with the medical faculty.

SUMMARY

The natural history of disease has been accepted as a basis of acquiring and organising knowledge regarding disease, defect and disorder.

Areas of study in fields of patho-biology, radiation biology, human genetics, nutritional physio-pathology and biochemistry have been defined on the basis of problems of concern to preventive medicine. A case has been made in support of inclusion of behavioral sciences in the curriculum.

On the basis of the discussion of the nature of specialisation and its scope, it is advocated that the level of knowledge to be gained in these fields should be of an analytical-synthetic order.

THESIS OR DISSERTATION AS REQUIREMENT

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THE basic purpose of postgraduation in preventive and social medicine is to equip the physician to provide specialist services in organising medical care in the community, to teach and to conduct research.

The subject of preventive and social medicine is gaining importance, not only in developing countries where communicable diseases are responsible for high morbidity and mortality, but in all countries where good results have been obtained by the application of the principles of epidemiology to the whole range of diseases. It is the subject which is now receiving its due attention in the teaching programme at the undergraduate level.

The methods of teaching are changing day by day in accordance with the facilities available in different countries. The teaching includes theoretical lectures, practical laboratory work, field trips, demonstrations, case presentation, discussion and the use of audiovisual aids. Whatever methods are evolved and applied, the object in view is to improve standards of medical care and to encourage research in community health problems.

Professional education like all education is self-education. Over-reliance on lectures for systematic coverage of a subject often has a stultifying effect on the effort of an individual student. The student should be given opportunity to learn, to observe, and to search on his own initiative. Given incentive and guidance to learn, the student will build the necessary foundation for his career in preventive and social medicine, be it teaching, research or administration.

judgement of conclusions reached in medical papers he reads, it sensitises him to inadequacies of evidence, increases his awareness of exaggerated claims, tempers his acceptance of enthusiastic predictions."

The solution for all this is to give an opportunity to the student to form his own judgement in the field and this *can be fulfilled only if the thesis or dissertation is included in* the postgraduate curriculum. Students should be given an oportunity to learn by doing, rather than by seeing and hearing alone. It will not be out of place to repeat the old saying at this stage: "what I hear I forget, what I see I remember, what I do I know."

When working for a thesis one has to define a problem and review the literature. The study of literature becomes essential in carrying out research projects, in determining what has been done before in that area and what remains to be done. This needs extensive reading of original papers, editorials, reviews, etc in the principal medical journals. One has to enunciate the problem, formulate the hypothesis, and plan the research study. While actually executing the *study, shortcomings of the original plan may be discovered. In this way a student* gains experience in planning research work. As the study proceeds he has to collect and compile data for analysis. The student, who generally avoids study of medical statistics in his undergraduate career, while working on a thesis, has to analyse and test his findings by standard statistical techniques and this makes him conversant with statistical methods and serves to train him in the use of medical statistics which will be of great help in his future career. By analysis of the observations, conclusions are drawn and discussed in the context of the work done on the problem by others.

In carrying out the task of working on a thesis, the student gets an opportunity, if he is passionate enough to break through the blank wall which stands in the way of his understanding. It provides lessons in team work, since team work is essential in the practice of preventive and social medicine, particularly while studying the epidemiology of any disease and dealing with community health. Work on a thesis brings the investigator into close contact with the community for studying problems in social and preventive medicine. The *methodology required in working on a thesis inculcates in the investigator a respect for routine.* Students working on a thesis get first-hand insight into the best of scientific tradition. It also brings the student and the teacher closer together than do most other activities and given good teachers, it enhances the grasp over methodology and thus helps the pursuit of scientific investigation even after postgraduation. Above all, it inculcates in the student a sense of *discipline and trains him in the objective* approach. It is truly an adventure for postgraduate students, an experience likely to colour his entire outlook on his future work. Work on a thesis gives him an opportunity to learn the art of making wise judgments based on scientific reasoning. It gives him an exemplary opportunity to apply the principles of scientific investigation often heard in theory, viz. observation, measurement, description and interpretation. One gets an opportunity in testing the validity of current belief and in extending the frontiers of knowledge, thus developing the ability to accept one's own or another's observations with caution and to interpret critically what is published, demanding documentation and conceding nothing to authoritarianism.

Discoveries are not made all of a sudden by amateurs. The history of all successful investigations carried out in the present century shows that only trained workers with a call for research and with patience, imagination and determination can succeed in unravelling the zealously guarded secrets of nature, and the requirement of a thesis is the first stage for training students in research.

The thesis should not be more than 100 pages including bibliography. At least one year should be devoted by the student to writing the thesis under the guidance of a professor or a teacher with research experience. The writing of a thesis is an essential aspect of postgraduate training in preventive and social medicine, without which the training will be incomplete.

Importance of evaluation

At present the postgraduate teaching in social and preventive medicine is confined approximately to half a dozen medical colleges in India. The students graduating with doctoral degrees are primarily meeting the needs of the departments of social and preventive medicine and a few of them find their way in senior administrative posts for providing health services.

Judged against this background, evaluation of postgraduate teaching in social and preventive medicine can be doubly useful if it can provide:

(i) an assessment of the students' performance giving them an opportunity to identify their major accomplishments, and

(ii) evidence of existing weakness so as to improve the teaching/learning activities. Needless to say, in the present phase of development of postgraduate teaching in social and preventive medicine, such efforts directed towards evaluation will be worth while from the point of view of correct assessment of students' performance and improvement in the quality of teaching.

Overall principle for developing evaluation procedures

The next question is how to introduce evaluation in a subject which has wide ramifications in the physical, mental and social health of the individual and the community. This poses a difficulty to some extent as it may not be possible to measure the skill of a student working in a laboratory. Even the postgraduate students in clinical subjects can almost immediately feel the impact of their newly acquired skill in patient care. This considerably helps in developing the techniques of evaluation but will not apply to the subject of social and preventive medicine where the impact of newly acquired skill by the student can be seen only after 4-5 years. It therefore gives an opportunity for careful planning to set up measurable indices for total evaluation. These indices may be broadly spread over two aspects of the evaluation process:

(a) What is of importance for evaluation? This requires identifying the specific objectives in the teaching and learning situation set up to meet the goals of postgraduate teaching in social and preventive medicine.

(b) How well are the goals being achieved? The task to undertake this work is comparatively easier after defining the factors indicated above. This will require setting up of criteria to measure the degree of efforts and achievement and development of the instrument to accomplish this task.

The discussion in the following pages is devoted to the development of a broad framework to serve as a guideline for evaluation. This guideline will have to be modified to suit the needs of any institution based on their resources (men and material).

against the other. But it concerns the highlighting of those aspects, inherent in each objective, which are important for evaluation.

The main objective for teaching in social and preventive medicine is preparing a doctor so that he can acquire qualities listed below:

1. Epidemiological and sociological thinking.
2. Social and preventive practice.
3. Developing the concept of team approach for solving community health problems.
4. Understanding the importance of organisation to mobilise community resources for preventive ends.
5. Teaching the subject of social and preventive medicine.

For example, in relation to epidemiological and sociological thinking the student should be able to give evidence of (a) correlating disease a to the environment in the family and the community, (b) understandig of social components of the multiple causative factors of a disease prevalent in a community.

These aims can be achieved by exposing the students' learning to facts, observation and participation in a number of *teaching situations* covering the hospital and other community resources. The teaching-learning situations which students cover when studying for the doctorate degree in social and preventive medicine are indicated very briefly in the accompanying table.

The pattern for evaluation when developed will have to *take* a realistic picture of the extent of teaching accomplished through organisation of *teaching sites* and covering the *teaching substance*. The terms 'direct' and 'indirect' for describing the teaching methods have been used to indicate whether the methods involve the direct participation of the staff of the department of social and preventive medicine or indirect participation through any other agency, e.g. institution or supervisor. Since a number of universities do not require full-time placement of the students for the full two years of the term for postgraduate course, it is of utmost importance for the department of preventive medicine to think of resources that can be mobilised for providing indirect teaching experience. The evaluation, however, cannot be carried out in relation to any one of the factors which may not have developed sufficiently to provide such experience.

How well are the goals being accomplished?

Since the emphasis has shifted from how well a subject has been taught, to how well the students have learnt, the evaluation technique may be developed to assess the extent of learning accomplished by the student, or even the lack of it. In the latter situation the technique may serve as a diagnostic tool for finding out the weaknesses in the teaching programme which may not have enabled the students to accomplish learning at the anticipated rate. The broad classification of evaluation techniques may therefore be developed around the activities of the student related to each one of the situations mentioned earlier. This may inclnde:

1. *Activities undertaken by the student*

(i) Assessment record, which may be developed for each student on his admission to

M.D. course. The records may document evidence of the student's resourcefulness or initiative or any other significant behaviour related to the training requirements.

(ii) Evidence of voluntary contribution made by the student. This may include any plan of work which the student may submit for either improving the quality of any aspect of services provided by an institution or mobilisation of community resources for solving the local health problem. It can also include spot epidemiological investigations or diagnostic studies which the student may carry out on his own initiative. The type of records as well as the progressive rating may be discussed with the student from time to time. This will also lead to the use of evaluation technique as a stimulus to help the student to do better and at the same time involve him in the evaluative process.

II. *Student's understanding of the subject*

A. *oral*

This may cover assessment of a student during class discussions, seminars and conferences or even informal discussions held with the faculty. Evaluation may cover a student's:

(i) grasp of the subject, that is, knowledge, comparehension, application and analysis;
(ii) his tolerance of others' viewpoints;
(iii) his ability to conduct meetings and discussions.

It is possible that some students may have a good grasp of the subject but are unable to conduct the meetings as well. It is, therefore, expected that as a part of their learning experience they will be exposed to conference procedures and ways to hold meetings.

B. *written*

Considering the number of teaching sites to which a student is exposed, there is no limit to the types of written assignments he may be expected to undertake. These assignments may cover:

1. A diagnostic study of community health problems.
2. Notes on field visits.
3. Review of published material.
4. Any other written assignment.

Students may be practically evaluated for their ability to:

(i) Comprehension
   (a) Integration (re-ordering, grasping the thought at any level of generality).
   (b) Extrapolation (predicting continuation of trends, utilising data to determine effects), *implications*.
(ii) Application—use of abstraction and principles in concrete situations.
(iii) Analysis—ability to reorganise unstarted assumptions and skill in distinguishing facts from hypotheses.
(iv) Synthesis—utilisation of facts for outlining a plan of attack.
(v) Test and examination.

During recent times considerable thought has been given to the importance of objective assessment of essay type papers. Those who are interested in this particular topic may kindly refer to the literature in this field. But it appears that objective assessment stage is comparatively free of personal bias during assessment stage. The task can also be easily accomplished by even other members of the faculty in the department of social and preventive medicine.

It is, therefore, worth while to develop objective tests in order to elicit a student's ability to apply the basic principles for solving the problem rather than merely to recapitulate facts and figures covered in the class room. The preparation of the objective test requires skill and co-operation of experts from more than one discipline like statisticans psychologists and educationists who have experience in preparing such tests. The assessment will be more meaningful if the tests are administered immediately when the students join the course as also after completion of the course.

As a long term measure one may even visualise the development of text-books in social and preventive medicine wherein the contents of each chapter may be followed by a guideline for preparing objective tests.

III. *Assessment of students' reading ability*

As student-cum-researcher the postgraduate student must develop the habit of reading as an integral part of the training requirements. Techniques may be developed therefore to assess students with respect to:

(i) Time taken for the reading of the assignments given.
(ii) Interest and comprehension will indicate:
  (a) voluntary reading of reference material (books and magazines); and
  (b) ability to keep up to date with the newer scientific knowledge as published in scientific publications related to the subjects under consideration.

IV. *Students' contribution*

As mentioned earlier, thesis appears to be the most important as well as the most time-consuming contribution by a postgraduate student. It is unfortunate as it distracts student from assimilating many other factors in the teaching-learning situation described earlier. It is, therefore, advisable to plan evaluative techniques to assess any other material which the students may be asked to prepare either through work in the laboratory or in the community or judge the student's ability to collect certain documents or materials of interest having a bearing on the problem of individual and community health.

V. *Preparation of the student as a teacher*

The evaluation techniques in this particular field may be directed to assess the student's preparation as a potential teacher in medical colleges. As a teacher he will be required to have a workable knowledge of curriculum planning and methods of teaching. In a subject like social and preventive medicine, because of the wide horizons, there is a tendency to depict it as a concept difficult to understand. It is, therefore, of particular importance that the

preparation of future teachers is adequate with respect to contents as well as methods of teaching. Spot evaluation techniques may be developed to assess a lesson plan which may cover (a) discussion, demonstration session or (b) even a lecture. Recently, some of these techniques were developed by the staff of the Family Planning Research Project for use in demonstration sessions on methods of teaching family planning, in a workshop sponsored by the Delhi branch of the Association for Advancement of Medical Education. Methods of teaching were tried for teaching the undergraduate on topics covering pre-clinical, para-clinical and clinical groups of subjects.

The methods of evaluation as developed were primarily focussed on immediate assessment of the teaching session. But it was felt that work may also be undertaken on developing intermediate and long term methods of evaluation.

In the end, I would like to emphasise that teaching of any subject has been described as a dynamic process. The evaluation techniques therefore must take into account all those factors which influence the teaching-learning situation. Also, comprehensive evaluation in postgraduate teaching of any subject will cover:

(a) Assessment of students before admission in the postgraduate course commonly referred to as screening.
(b) Evaluation during the period one is a student.
(c) Long term evaluation after a student's completion of his doctorate degree.

This paper has been developed mainly to consider evaluative techniques for postgraduate teaching in social and preventive medicine. Two other aspects are closely inter-related. Comprehensive evaluation of teaching can, therefore, be carried out only when efforts are made to develop techniques covering the entire phase of activities mentioned above.

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Table No. 1

TEACHING SITE	TEACHING METHOD	TEACHING SUBSTANCE					
		Behavioural sciences	Bio-statistics	Natural history of disease	Epidemiological investigations	Comprehensive clinical medicine	Community health care
1 Hospital O.P.D. indoors	Direct Indirect						
2 Urban and rural practice field	Direct Indirect						
3 Community health agencies, industrial group	Direct Indirect						
4 Non-medical units with preventive functions	Indirect						
5 G. P. clinic	Indirect						

TEACHING OF PREVENTIVE AND SOCIAL MEDICINE

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SOCIAL and Preventive Medicine refers to a method of practicing medicine whereby all of the aspects of a complete health service, which may be applicable to the solution of a particular health problem, are applied simultaneously or in appropriate order. Thus social and preventive medicine is not a speciality in the usual sense.

Public Health or perhaps better Community Medicine on the other hand is one of the major medical specialities along with medicine, pediatrics, surgery and obstetrics-gynaecology. Aggregates of people require the services of a physician in the same sense as an individual or a family requires a physician. Although there presumably will always be a need to maintain separate institutions to train individuals specialising in community medicine, medical colleges should also play a major role in the training of these physicians. This is particularly true as regards the training of the physician who will have the role of medical officer in charge of a Community Development Block health service

A major deficiency in our present medical education system is the absence of a practical opportunity for all of the medical college departments to join together in a demonstration of the practice of social and preventive medicine. To make this possible a basic unit of population should be selected and the various departments then join together in developing an adequate total (comprehensive) health service for everyone living within the area. The community development block would seem to be the logical population unit for a medical college teaching and research unit in social and preventive medicine.

In an undertaking of this nature the department of social and preventive medicine would complete the comprehensive medical care service by assuming full responsibility for planning, organising and directing the public health or community health services. Under such a regime, it might eventually prove desirable to change the present name to the Department of Community Health. This, in fact, is the true "speciality practice" responsibility of this department.

TEACHING OF OCCUPATIONAL HEALTH AS AN ESSENTIAL REQUIREMENT IN THE TRAINING OF POSTGRADUATES FOR M.D. IN PREVENTIVE AND SOCIAL MEDICINE

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THERE is an increasing acceptance of the principle that training of medical graduates should be related to the present and expected needs of the community. As the needs of the community change over a period, a review of syllabus and methods of medical education becomes necessary from time to time.

The importance of occupational health as an essential part of the training of medical graduates has been well recognised since long. That its scope in the training should be considerably augmented has been repeatedly emphasised at the various committees and associations of W.H.O./I.L.O.

As a result of these considerations, many universities in the U.K. have increased the number of hours allotted to training in occupational health in the undergraduate curriculum and have instituted special courses for postgraduates.

In India, however, the importance given to the subject of occupational health has not yet been adequately reflected in the educational programme although the country is going through an industrial revolution.

The University of Calcutta is awarding a diploma in industrial health (D.I.H.) which is oriented predominantly to industrial hygiene techniques. The clinical aspects of industrial medicine do not have adequate representation and the whole training is given in a setting where it is difficult for students to appreciate that occupational health is a part of a broader concept of preventive and social medicine.

The field of occupational health is the one sphere where research and experiments in training are likely to be particularly rewarding.

A specially selected teaching hospital with the departments of medicine, neurology, dermatology, ophthalmology, surgery and rehabilitation can provide enough material for clinical training in occupational health, while a selected department of preventive and social medicine can furnish the proper type of nucleus, where training in occupational health can be given as a part of training in preventive and social medicine. Other departments particularly departments of anatomy, physiology, biochemistry and radiology have also a substantial part to play.

It is therefore of vital importance that for postgraduates in preventive and social medicine the training in occupational health be strengthened and the course proposed in Appendix A be introduced. Scrutiny of the appendix will show that the training syllabus will have the following as its essential components.

(a) Didactic teaching, e.g. lectures, seminars/symposia and panel discussions.
(b) Attendance at a specially organised occupational health clinic.
(c) Ward teaching in clinical medicine, particularly in occupational diseases.
(d) Training in accident surgery and rehabilitation.
(e) Work in industrial hygiene laboratory to acquire familiarity with techniques of analysis of industrial dusts and toxic chemicals, analysis of various body fluids to detect and measure industrial poisons and use of instruments to assess temperature, humidity, comfort, lighting, noise and dust exposure.
(f) Field work:
 (i) Observational visits to factories representing important and hazardous industries in the country.
 (ii) Attachment at a well organised industrial medical unit for one month.

The approximate number of teaching hours to be devoted to each component is also indicated in the appendix.

APPENDIX A

PROPOSED COURSE ON OCCUPATIONAL HEALTH FOR M.D. IN PREVENTIVE AND SOCIAL MEDICINE

1. Didactic teaching, i.e. lectures, seminars, symposia and panel discussion, 1½ hrs. each.
 Development and scope of occupational health.
 Medical services in industry.
 Effect of heat and its management.
 Effect of noise on hearing and its measurement.
 Effect of noise on performance of workers in Industry and control of ill effects.
 Ionising radiation and radio isotopes.
 Effects of ionising radiation.
 Protection from waste-materials and their disposal.
 Industrial dermatoses.
 Industrial psychology.
 Efficiency in Industry and personal factors in accidents.
 Maladjusted worker in Industry.
 Care of the physically handicapped in Industry.
 Toxic industrial compound and their detection in workers.
 Eye affections in Industry.
 Pnemoconiosis.
 Industrial physician and his role. 26 hours
2. Attendance at a specially organised occupational health clinic, 12 attendances. 30 hours
3. Ward teaching in clinical medicine including industrial medicine. 30 hours
4. Training in accident surgery and rehabilitation.
5. Work in industrial hygiene laboratory of Chief Advisor of Factories in Bombay (Section VI-b below). 1 month

6. Attachment to Industrial Medical Unit of Tata Industries. 1 month
7. Field visits to:
   A textile mill.
   A pottery manufacturing factory.
   A rubber goods manufacturing factory.
   A chemical works.
   Bhilai steel plant.
   Jabalpur manganese mines.
   Tanneries at Kanpur.

REPORT OF THE SUB-COMMITTEE ON PREVENTIVE AND SOCIAL MEDICINE

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THE sub-committee reviewed the requirements of the country for specialists in preventive and social medicine for public health departments, meeting the needs of teachers in preventive medicine in medical colleges and those of research workers in community health. The group felt that there is an urgent need to develop postgraduate training in preventive and social medicine. The training should be of two types: (1) diploma in public health to meet primarily the needs of staffing the community health schemes; and (2) M.D. (Preventive and Social Medicine) to provide for teachers in the department of social and preventive medicine and senior administrators and research workers in community health

SELECTION OF CANDIDATES

Candidates for the diploma in public health should have full registration. Candidates for the M.D. (Preventive and Social Medicine) should have completed one year of house-surgeoncy after full registration. This year should be spent as demonstrator in the department of preventive medicine or as house-surgeon in a health centre. Preference should be given to applicants already possessing a postgraduate diploma in public health or any other field, to those who have worked as junior teachers in preventive and social medicine, and to those having experience in community health work. These qualifications may be relaxed for individal students in the light of teaching, field research or military hospital experience.

health chemistry, microbiology (including medical entomology), biostatistics, and the social sciences (including social psychology). The study of preventive and social medicine at an individual level should include personal health services during the entire cycle of human life. Study at the community level should include comprehensive medical care, communicable diseases, health education, family planning, applied pediatrics, gynaecology and midwifery, occupational health, and rehabilitation.

EXAMINATION AND ASSESSMENT

There should be two examinations for the M.D. (Preventive and Social Medicine). The first should be held at the end of the second year of study and cover basic sciences as related to the speciality. The second examination, given at the end of the third year, should be in two parts. First, the thesis should be assessed by one internal and two external examiners. When the thesis has been accepted by the three examiners, the candidate should be allowed to take the second part of the examination which consists of three or four theoretical papers and practical and oral examinations. At least 50 per cent of the examiners should be external examiners, and should be drawn from the discipline of preventive and social medicine.

INSTITUTION REQUREMENTS

An institution accepting postgraduate students tin this speciality should have a department of at least five years' standing. It should have appropriate physical facilities such as laboratories, lecture rooms, a library, and a museum. Laboratories should be equipped for routine public health chemistry, microbiology, entomology, and biostatistics. The department should have teaching aids for community health to be used for and by postgraduate students. Both rural and urban practice field areas should be an integral part of the institution, and adequate transport to and from and housing in these areas is essential.

The teaching staff of the department should include: a professor, two associate professors, an associate professor or applied social sciences, assistant professors of community medicine and health administration, environmental and occupational health, biostatistics, and public health engineering, a lecturer in health education, a statistician, and two medico-social workers. The rural and urban health centres should also have an experienced medical and para-medical staff to guide the postgraduates.

Because of the urgent need and dearth of candidates for postgraduate training in this field, the junior staffs of the institutes where facilities are inadequate for postgraduate training should be supported at full pay while they go on study leave to other institutions. All M.D. candidates should have fellowships, and house-surgeoncies should be established in teaching hospitals and their associated rural and urban health centres to attract new graduates to the discipline of preventive and social medicine.

the regulations concerning them, a three-year work in the subject in which the degree is desired is made a prerequisite, and out of these three years some universities insist that at least one or two years must be spent as House Officer (Resident) in a recognised hospital. It would appear that a minimum of three years' apprenticeship is satisfactory. In practice, however, one fairly often finds that the first attempt is made at these examinations four or even five years after obtaining the M.B.B.S.

As I have already said, a fixed, though not rigid, curriculum is prescribed for the diploma examinations, but for the M.D. and M.S. this is not the normal practice. The object in the former is to train persons who can deal with routine work concerning the speciality and be competent to deal, with some skill, with certain emergencies The scope of the latter is much wider, because the aim is to turn out such persons as can be relied upon not only as consultants, albeit junior consultants in the beginning, but can be recruited also for the teaching posts in the medical colleges. Hence it is not considered necessary and wise to restrict the scope of either the training or the acquisition of knowledge by the candidate The inclusion of general medicine and surgery in the teaching and training programme deserves special mention since the controversy, whether every specialist must be highly efficient in general medicine or surgery before he specialises or he need not be so, has not yet been settled The extremists insist that every candidate who wants to specialise must first obtain the M.D. or M.S. in general medicine or surgery, and then proceed to the degree examination in the speciality after one year. In the first place, after having spent 2 to 3 years, at least, preparing for the M.D. and M.S. in general medicine or surgery, how can he be expected to acquire proficiency in the speciality in one year only? This clearly is not possible. Secondly, as conditions obtain, specialisation has advanced so much as to leave hardly anything with general medicine and surgery. However, it must also be admitted that a specialist should have a good training in the principles of what is called general medicine or surgery; I would like to call them the essentials of medicine and surgery.

III. METHODS OF TRAINING

There are two methods of training: theoretical and practical. Theoretical training imparted through the medium of books, lectures, seminars, group discussions is an essential foundation on which the student builds his knowledge, and through this also he extends the scope of his knowledge to enable him to have sufficient mental capacity to Integrate various facts and to develop a critical sense. However, it would not be beneficial to concentrate on one method alone. For instance, if the student were to confine himself to reading several books and journals, he gains a large fund of information, but without seminars, tutorials or group discussions, he is not able to convert all this information into knowledge.

The other part is the practical training—clinical, laboratory and operatives—that is, learning to carry out procedures requiring technical skill. Medicine being as much of an art as a science, practical training is most essential As a matter of fact, it may be possible to lessen the time spent in attending formal lectures without much detriment, but no curtailment should be allowed in the opportunities provided for acquiring practical skill. Needless to say, the principle of graduated responsibility is the basis of practical training, and this is followed in most of our

institutions particularly in those where the 3 or 4 years' residency scheme is obtainable. The pre-clinical training must obviously be imparted in the laboratory or the dissection hall and the museum. It is advantageous if the clinical teachers also participate in the preclinical teaching of the students. It is felt that this will ensure to a great extent the inclusion of such topics in the pre-clinical course as the clinician knows by experience to be of greater relevancy. At the very least the teachers of pre-clinical subjects would do well to consult the clinician before they draw out a curriculum. The applied aspect of the basic sciences should be emphasised.

IV. TEACHING OF BASIC SCIENCES AND PATHOLOGY

Basic sciences and pathology form the bed-rock of clinical studies. Teaching of these subjects as a part of training for the higher qualifications has been adopted in some form or the other. Some universities insist on a fixed course of studies, some depend upon an examination in these subjects, no matter how the study is carried on and where, while still others make it a part of the final examination without holding a separate examination like Part I or the primary examination.

The aim is to ensure that the candidate has learnt adequately these sciences and that he has an intelligent grasp of the clinical part of his studies. This also implies that the study of these sciences should be such as to lay emphasis on the applied aspects of anatomy, physiology, and pathology. The next consideration is the method by which this training is to be imparted. Should these be formal lectures only, or should lectures be combined with demonstrations—which may be termed lecture-demonstrations, or even practical classes? During the undergraduate course a good deal of practical work in the laboratory is done together with demonstrations by the teachers and it would not be advisible to cover the same ground again in as great a detail. It would perhaps be advantageous at first to have formal lectures on general principles of physiology, a formal survey of the human anatomy and general pathology, and then to select such portions as are relevant to the particular speciality for further intensive study by means of lecture-demonstration, and even by anatomical disection, whenever possible. The duration of such training will depend upon the total duration of the course prescribed. As an example, in the diploma examination it is customary to devote the first six months to the study of basic sciences at the end of which there is an examination—the Part I, primary examination—and the next six months are entirely devoted to the clinical study and practice of the speciality. In the case of M.D. and M.S. degrees the course can be extended to one year if the total duration of the course is three years. It is not necessary to hold a formal university examination in these subjects; the teacher must be satisfied that the candidate has put in regular attendance and by informal questioning he should find out and certify that he has acquired the requisite knowledge of the subjects. It must however be admitted that prescribing a particular duration for the study of basic sciences has one drawback and this is that once the student has finished with it he tends to forget much of what he had learnt. Hence the idea that the teaching of basic sciences and pathology must run concurrently with the clinical studies and, instead of having a separate examination for the former, a knowledge of these sciences should be evaluated along with the clinical subjects. This will do away with Part I or the primary examination in the M.S.

V. THESIS OR DISSERTATION

Both are in the nature of a mental exercise; one is more than the other in the content and duration. Where thesis forms only a small part of the examination it is regarded as a passport to proceed further. In some universities, however, there is a special regulation by which a candidate can supplicate for the higher degree by submitting a thesis only after 10 years of graduation as is done in the case of Ph.D or D Lit., and in such a case the work on the subject is carried out for not less than two years, and attempts are made to contribute something original It is not possible for various reasons for many students to spend that much time and also attain a high standard of work. Therefore, a thesis which can be prepared in say six months or a little more, but is a modest effort to study a particular problem honestly, should be a sufficient prerequisite. Most universities limit the length of the thesis to 100 pages, preventing thereby inclusion of unnecessary written meterials merely to make the thesis look bulky and more respectable and learned. In practice dissertations are nothing more than a collection of about 20 case histories with a short review of the relevant literature. The candidate tries to expand it by giving several pages of historical or anatomical or physiological data. The conclusions drawn are based upon too small a number of cases, and might be misleading in various ways. It is therefore desirable to have a thesis rather than a dissertation. In the past in my university (Lucknow) if a thesis was judged as of a high merit the candidate was exempted from the written part of the examination, and had to appear in the practical and *viva voce* only.

VI. METHODS OF ASSESSMENT

Objectivity should be the basis of any method of assessment. In formal examination, theoretical, i.e. written, and practical and *viva voce* have been considered the best methods so far, to assess a candidate's ability. This brings in a controversy which has been raging for a long time. The consensus of opinion, however, seems to be that examinations are a necessary evil, but every attempt should be made to minimise the evil. It is said that the aim of an examination should be to find out how much the candidate knows and not how much he does not know. Generally speaking, this is a desirable consideration but sometimes what the candidate does not know becomes of immense import, specially in medicine, where ignorance can be fatal. Therefore, what the candidate does not know cannot be ignored altogether, but the examiner should assess whether the ignorance of particular facts is trivial or serious, whether, again, the mistake is made as a result of a genuine lapse of memory or is due to complete ignorance. A well known defect in all formal examinations is that the examiner is called upon to judge the candidate's ability within a short time—a few hours when the candidate is certainly emotionally upset, when he is working under a mental strain of anxiety and fear, and also under a physical strain. This means that apart from memorising facts he must have all his wits about him in order to succeed. To overcome this, it has been suggested that an appraisal of the candidate's day-to-day work in all aspects should be given equal credit with the written and *viva voce* and practical tests in the final assessment. In practice, because of the presence of one of the teachers of the candidate as member of the-

Board of Examiners, this is taken into account, particularly if the candidate is what is called a border-line case, and the verdict of the internal examiner as to his abilities as a practical physician or surgeon may tip the balance in his favour. In some universities or examining boards there are no internal examiners. In order to make this practice uniform and as objective as possible, a record of the candidate's day-to-day work should be maintained, duly certified by his teacher that it is up to the required standard. A judicious combination of these two methods would eliminate the elements of chance or luck from the examinations, and will provide proper recognition of the candidate's worth.

METHODS OF SELECTION AND REQUIREMENTS OF POSTGRADUATE STUDENTS

Dr. A. Sinha

METHODS OF SELECTION

IN considering the methods of selection it is desirable to consider (i) the type of candidates who will be suitable for training as postgraduate students and (ii) the type of work that they are likely to be called upon to do after selection and training.

OBJECT OF SELECTION

The selection of postgraduates in otolaryngology and, for that matter, in any other speciality is to find out and select:

(i) Meritorious candidates who possess the necessary intellectual ability to pursue and derive the maximum advantage from postgraduate studies.

(ii) Candidates with keen and strong motivation to become specialists, who wish to apply themselves with vigour and enthusiasm so as to practise the speciality with efficiency and to advance its causes.

(iii) Candidates with a flair for journalism so that they could contribute and share their experiences to the advancement of the speciality and may act as future leaders in these specialities.

In order that a selection may be effective and fair, we have to evolve a method by which only suitable candidates are considered and taken up for training.

Any method of selection has to aim to collect information and data in various ways to screen the applicants. The first screening may be done on the basis of information collected from the applications sent by the candidates who wish to take up postgraduate training. This will include, apart from personal data, information regarding academic and extra-mural activities as well as names of referees. It is customary to lay emphasis on the percentage of marks secured by the candidates at various professional examinations as a basis for selection. It is difficult to see how this can be under-estimated or given up. Candidates who fail at more than two professional examinations need not ordinarily be considered for selection to a postgraduate course.

The extra mural activities may be regarded to project the leadership qualities in the candidate.

The next step in the selection concerns qualities and requirements of non-intellectual nature, such as motivation for the particular speciality as a career, which should be both keen and self-inspired, as well as other qualities like emotional stability and physical abilities of an individual. This cannot be easily evaluated. However, information can be collected from

such sources as references from the principal of an institution or the head of the department with whom the candidate worked, or from the warden and other faculty members with whom the candidate may have come into intimate contact. This is expected to give information regarding aptitude, application, interests and character of the applicant. Best of all this can be achieved through a personal interview. The value of interview can be debated. But it offers an occasion when the candidate can personally visit the department he is likely to join and meet the members of the staff. It also gives an opportunity to the selecting authority to clarify points mentioned in the application form and detect gross-deficiency in personality, such as mannerism or emotional instability or a physical handicap which are likely to interfere with the candidate's ability to pursue his studies or discharge his responsibilities as a specialist.

In the above context it may be noted that, in case of candidates who are graduates of the same institution where they want to do postgraduate studies, the selecting authority may be in a better position to assess the motivation and other abilities of the candidate. Difficulties are experienced more often when candidates from many institutions in different universities are to be screened.

To summarise, the method of selection should be:

(a) Preliminary—By screening of applications of the candidates along with the remarks of the referees.
(b) Personal interview.
(c) A short medical check-up before the final selection.

REQUIREMENTS FOR SELECTION

The requirement for selection of postgraduate students can be stated rigidly or may be of a flexible nature. But in the best interests of postgraduate training there should be:

(i) A minimum basic requirement for selection; and
(ii) Additional requirements.

Further, the requirements will vary according as the postgraduate training to be given is on a diploma level, e g. D.L.O., or the degree level, such as M S. In the former case the requirements may be relaxed more than in the latter.

The following suggestions for requirements are made to form a working basis:

(a) For M.S.

(i) Practical experience as house surgeon of 1 year in otolaryngology and 6 months in medicine or surgery or any of its other specialities.
(ii) Operating experience and experience of emergency surgery (such as casualty) should be obligatory and both of these should be adequate. The candidates may be required to furnish a list of operations performed along with their application forms.
(iii) The aptitude for postgraduate studies as revealed by taking part in seminars, discussions, presentation of papers at conferences and meetings and other medical journalistic activities. These are to be regarded as desirable qualities, but not obligatory.

METHODS OF SELECTION AND REQUIREMENTS OF POSTGRADUATE STUDENTS

DR. A. SINHA

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centres they are full-time students, while at others they are allowed to take up house jobs. It is considered that the latter course saves time and permits the students to earn while learning. Further clinical training is essential as there is no compulsion to work as house surgeon after obtaining the diploma. It is therefore recommended that the course and duration he as follows:

(i) Basic Sciences—3 months (anatomy of head and neck and general physiology can be excluded).

(ii) Clinical teaching—6 months (excluding cancer surgery and microsurgery of the middle ear); lectures and seminars.

(iii) Throughout the 9-month course students should be made to work in O.P.D., inpatients and assist in the operations. They should be entrusted with emergency work under supervision.

(iv) Three months of compulsory whole-time resident internship at the end of the 9-month course before awarding them the diploma in laryngology and otology. During this period they should be taught to operate on tonsils. Also they should know nasal surgery and simple mastoid operations.

(b) M.S. (otolaryngology)

Methods of selection will be discussed separately but one may be permitted to state that a brilliant academic record, a house job in medicine, surgery and E.N.T. of 6 months' duration in each should be the minimum qualifications for entry into this course. Another 18-month course is envisaged for these students. The aim of training such candidates should be to produce (i) highly trained specialists who could provide advanced surgical treatments relating to otolaryngological diseases in well equipped hospitals ; (ii) teachers for medical colleges.

Out of 18 months, the first 6 months should be devoted to basic sciences, general surgical principles in the afternoons and clinical work in the mornings. The scope of anatomy should be extended to head, neck and chest. Physiology should now include respiration, haemorrhage shock, coagulation, eletrolyte, and fluid balance. Pharmacology, general pathology and surgical pathology as related to otolaryngology should be included in the syllabus. General surgical principles should include neck swellings, cleft palate, diseases of lip, jaw, tongue and salivary glands, anaesthesia, cardiac arrest, tetanus, head and chest injuries. These details have been given to indicate how the course will differ from D.L.O. An examination at this stage should be conducted but teaching of these subjects in a brief way should be integrated during the remaining one year when mainly E.N.T. diseases are being taught During this period the course should be more comprehensive although details of rare diseases should be still left out. Our aim even now should be thorough training in common disorders with emphasis on practical aspects rather than theorical. Students should be encouraged to read journals at this stage.

(b) For D.L.O.

(i) Practical experience as house surgeon for 6 months in E.N.T. and 6 months in medicine or surgery or other specialities.

(ii) Operating and casualty experience. No insistence will be laid on the amount and quality of operating experience.

(iii) Interest taken in medical journal—not obligatory.

It will appear that apart from the requirements laid down the method of selection suggested is comparable to other National Public Services, which includes interview and medical check-up. These are highly desirable as the responsibilities that come to be borne by the specialists of the profession after completion of their postgraduate training are of an unusually onerous nature. It is highly desirable that the criteria of selection and methods used should be highly selective and prudent. This will bring in the best among the profession to the level of specialists, and add to the prestige and respect that this group of professional men may command in the public and government.

In the end a bold experiment is suggested, in order that it can be made feasible through the agency of the Indian Association for the Advancement for Medical Education, and that is to hold a *central examination* for the sake of selection to postgraduate courses in the specialities. On the result of this examination and in order of preference of the candidates a method can be evolved by which the different candidates will be assigned to different postgraduate departments and institutions for their training. This will be an important factor in regulating standards of selection and training on a national level. However, this point need not be pressed at the present juncture.

POSTGRADUATE EDUCATION

It may be considered under three headings.

(a) Diploma in otolaryngology.

(b) Master of Surgery in E N.T. diseases.

(c) Post-doctorate training, research, and education.

(a) Diploma in otolaryngology

It is a useful qualification to retain in our country, although it has lost its importance in the U.K. since F.R.C.S. (otolaryngology) was instituted. Our country presents a massive problem of medical care, especially in otolaryngology. At present there are not enough specialists to go to district towns. The district towns have small, inadequately equipped hospitals where it is no use posting a highly trained M.S., as he will only feel frustrated in those surroundings. It is therefore obvious that under the present circumstances our aim should be to train a D.L.O. candidate adequately in the shortest period possible so as to enable him to accept the responsibility of routine E.N.T. care and surgery so badly needed by the masses both in small and large towns.

The present one-year course is adequate. At present half of the one-year period is spent on the learning of basic sciences. It is felt that it should be cut down to one-third. At some

METHODS OF TRAINING OF POSTGRADUATES IN OTOLARYNGOLOGY

G. M. TANEJA

Professor, Medical College, Amritsar, Punjab

THE postgraduate student of Otolaryngology has one or more of the following objectives in view when he seeks admission to one of the posrgraduate courses:

i. Teaching work.
ii. Clinical research.
iii. To better his qualification and then enter into private practice with an advantage over others.
iv. Taking up the job of a specialist in a district hospital or in a medical establishment of a private or public sector or in commercial undertaking.

The training programme for the postgraduate has to take cognisance of these requirements. The requirements of training for one type of objective differ somewhat from those of another For instance, the training for a diploma course has to be more "practically oriented" since the persons engaged in such training, barring a few exceptions, during their employment as specialists will have no occasion to work with and learn from others doing similar type of work; whereas, in case of persons engaged in training for a postgraduate degree, who later on find employment in teaching institutions, the conditions are more favourable for acquiring practical training even after the acquisition of the degree. For a person who is to take up teaching work nothing extra is required in training. The knowledge he has gained in acquiring the qualification and the art of expression he has developed during training is enough for his work. *But for research work, the student has to be trained to be very* meticulous as to the details of method. He must always be ready to doubt the validity of his own observations in a given experiment, and he has to be absolutely objective in the interpretation of results. A training in statistical work is a must, moreover he should be imaginative.

The training for each one of these objectives need not be mutually exclusive, since there is much that is common between them. Apart from the needs of a diploma student in whose case lacunae in practical training would be inexcusable, the rest of the postgraduate trainees can be easily covered by one composite training programme, with due emphasis on the methods of research. In most Indian Universities this last is achieved by allotting a problem to a student who prepares his dissertation receiving instructions from his mentor.

For clinical training not more than 6 students should be taken up by one teacher at a time. Clinical responsibility should be assigned to the students throughout the period of 18 months on a full-time residential paid basis. They should run the out-patients, in-patients, attend to emergencies, assist and operate. They should run special clinics under supervision, viz. aural clinics, cancer clinics, clinics for deaf mutes, and audiology clinics. Radiological and clinico-pathological conferences should be held frequently. Suitable well-equipped temporal bone surgery units should be set up to train the students in surgical techniques. Thesis should be dropped from the M.S. course.

In the end it is to be emphasised that a good teacher requires no guidance as to what to teach or what not be teach if he knows the future requirements of his students. However, a tendency on the part of the examiners to ask about the minutia of rare conditions encourages the students to cram more and more theory and devote less and less attention to the clinical practice. Hence while examining one should ask more about common disorders rather than about rare diseases or complicated procedures which are unlikely to be practised by the students for some years to come.

(c) Post-doctorate training

Students passing M.S. have to wait for a considerable period before finding a suitable post. This period may well be spent as follows: (i) They should be given research followships for a year or longer. Now that they are conversant with basic sciences, clinical problems, mature in outlook and free from the worries of the examinations, they will be able to devote themselves to research, learn its techniques and perhaps produce worth-while work. Along with research work in the afternoons they should be allowed to do clinical work in the mornings during which time they should help to teach undergraduate students. Research should not be essential but taken up only by those who intend to become teachers or wish to take up research as their careers. Their research work should be taken into consideration when taking them into the teaching profession. Apart from this incentive for taking up research work, medical teachers should be the highest paid not only in their own profession but even as compared to other services to attract the right type of candidates. (ii) In certain super-specialities a candidate may not get opportunities to see enough work in certain centres. Hence cours s in certain subjects, e.g. endoscopy, cancer surgery, faciomaxillary and plastic surgery, audiology, deaf-mute child, speech therapy and temporal bone surgery should be held at certain centres where the students can be sent on fellowships or at their own expenses in case they wish to specialise in any of these branches.

However a better alternative would be to establish 4 to 5 regional otolaryngologic institutes where all the above specialities should be instituted so that a student during his M.S. course can rotate through all these specialities and specialise in any one of them by undergoing training for 3 to 6 months after M.S., if he so desires.

THEORETICAL TEACHING

1. Didactic Lectures

For a postgraduate, undeniably, the proper place to learn from is monograph. The lectures have no more value beyond providing a scaffolding for further knowledge. They should only provide the basic fundamentals on a topic. Their main advantage is that being less detailed than the subjects discussed in seminars and journal club meetings, a good lecture can broadly cover a subject. Ample use should be made of line diagrams, films, and epidiascopic presentations. A guide to further reading must always be provided at the end. The number of lectures must be kept to the minimum and they should be gradually replaced by symposia, seminars and journal club meetings.

2. Seminars

On important subjects, which require very detailed study, postgraduate students are allotted topics on their different aspects. The student reads the subject extensively, sums it up and presents it, as a paper. The other students who have read the subject discuss the paper. The chairman, usually a senior teacher, sums up the subject, fills up any lacunae left, and emphasises the points not properly stressed by the seminarist.

3. Journal Club Meetings

The student is asked to read a particular paper or papers of current interest. His paper is inspected in the original. It is suggested that before any fresh plan of work is taken up it should be critically discussed by a group of postgraduate students and teachers particularly regarding the scope of enquiry and methods and material.

Such discussions will have the merit of giving the plan a proper, scientific background. The summary is read in the Journal Club Meeting. This method is particularly useful for reading long and complicated articles. Now-a-days since the material being published is quite large this practice is being adopted more and more.

CLINICAL TEACHING

1. Lecture Demonstrations

These are held on patients. Usually an admitted patient is allotted to the student one evening before the lecture demonstration He examines the case and reads about the case. The case is then presented before the class; the student discusses the clinical findings of the patient, the line of investigation, and treatment. Further the teacher comments on the presentation and sums up about that particular disease. For clinical teaching, lecture demonstration is the ideal forum. Collected materials such as slides and figures from cases of the same disease seen in the past should be presented by the teacher. Thus lectures by demonstration combine the merits of a lecture by going into the details of the disease and even into those clinical features not demonstrable in the case under discussion.

DURATION OF TRAINING PROGRAMME

I. The programme for postgraduate degree should be long enough for a broad-based training in basic medical disciplines like anatomy, physiology, biochemistry and pharmacology on the one hand, para-clinical subjects such as pathology, bacteriology, radiology and radio-therapy on the other, and in addition the candidate must have sound training in principles of surgery. The total period of teaching suggested is three years which may be distributed as follows:

1. Basic Medical Sciences

The first semester may be devoted to the study of anatomy, physiology, pharmacology and biochemistry.

The instruction in anatomy should include dissection of selected parts and demonstrations on dissected specimens.

2. Para-Clinical Subjects

The second semester may be devoted to the study of pathology, bacteriology, radiology and radio-therapy.

3. General Surgery, Thesis and Allied Disciplines

The 3rd and the 4th semesters may be devoted to preparation of dissertation and training in general surgical clinics and allied disciplines like anaesthesiology and plastic surgery. During this period the student must receive a thorough guidance in methods of research

4. Otolaryngology

The 5th and the 6th semesters should be devoted to the speciality of otolaryngology exclusively.

II. For diploma course the duration of training should be one year, the first six months may be devoted to training in basic medical sciences and para-clinical subjects, the second in the study of the speciality and principles of surgery.

RESEARCH WORK

The work put in by the trainee must be original and his approach scientifically valid. Collection of references and views of literature are important only to give the work a proper perspective. By themselves they are not enough. Emphasis must be on the candidates' own observations and their own unbiased and critical evaluation. Conclusions are not so important. He must learn to appreciate the shortcomings inherent in a particular experimental situation, and, how and where fallacies can creep in. Assignment of a problem is meant to train the candidate in the methods of scientific enquiry and observation. Usually one finds that, out of a hundred odd pages or so over which the candidate is supposed to have laboured for months, the chapters on methods and materials and observations which should form the back-bone of any scientific enquiry form instead the weakest link. The practice of preparing dissertation from old hospital records of a particular disease is undesirable.

clusion he discusses the post-mortem pathological data and correlates it with the antemortem data. The clinical approach is subjected to the *scientific test of post-mortem study*. *New* facts are added to the existing knowledge about the presentation of the disease process.

II. Similar conferences can be held in cases where no definite diagnosis is arrived at pre-operatively, despite thorough clinical examination and investigation. The case is submitted to a surgical examination and biopsy, the findings being kept back until the pre-operative data are thoroughly discussed.

8. Tutorial Group

The postgraduate student should be entrusted with tutorial work for undergraduate students. The best way of learning is by teaching.

I have a firm conviction that postgraduate teaching should not be undertaken in institutions where undergraduate teaching does not exist. To do so is to build a house without a plinth.

9. Ward Work

The student is allotted beds in the wards. The student should be charged with the responsibility of maintenance of records, investigation and follow-up of patients admitted on these beds.

OPERATIVE SURGERY

Operative surgery classes can be held on the cadaver and dried bones. In otolaryngological surgery most procedures can be learnt from work on patients only, and as such the student should have ample opportunity of assisting in the operations. Besides he should be allowed to handle certain surgical procedures under supervision. Facilities for experimental surgery on animals and micro-surgery should be available.

INVOLUTION TO EMINENT LECTURERS

India is a vast country and frequently one clinic is more advanced in dealing with a particular problem for reasons of regional prevalence of a particular disease, existence of special facilities, or due to a particular interest of the staff working there. Invitations for lectures on specially chosen subjects to eminent teachers from those institutions will be very helpful for postgraduate teaching. Moreover this will create interest and give encouragement to the persons engaged in such work. Students may themselves visit centres advanced in a particular field.

2. Clinical Demonstration

In the out-patient department a case is selected and allotted to the student who examines the case in about 30 to 40 minutes and presents it before a class. The clinical findings of the student come under thorough scrutiny. A discussion on tentative diagnosis, differential diagnosis, and the line of investigation follows This is the method *par excellence* for teaching of clinical methods to the undergraduates as well as postgraduates. The number of clinicals demonstrations should be as large as possible.

3. Ward Rounds

Bedside teaching lays stress, first, on physical signs, their day-to-day evolution and, secondly, on the management of the patient. This is the only place for teaching of management of emergencies. What the student sees in the ward gets firmly fixed in his mind.

4. Group Discussions

The postgraduate students learn more clinical medicine by discussion amongst themselves than from their teachers in lectures or lecture-demonstrations. When not in the class the students tend to be more ruthless in criticising a fellow student and the latter is equally determined to defend himself. Therefore such discussions help to form the habit of logical thinking that helps to form the foundation of sound clinical medicine.

5. Clinical Meetings

In these meetings interesting and uncommon cases are presented by postgraduate students or junior teachers to combined gathering of postgraduate students and teachers of various clinical subjects.

6. Inter-Departmental Meetings

Problem patients of mutual interest can be brought up for discussion before a combined meeting of the departments or specialities concerned This serves to provide useful information and broadens the general outlook of the postgraduate student.

7. Clinico-Pathological Conference

I. Such patients from the whole of the institution whose diseases remain undiagnosed till death are subjected to pathological post-mortem in strict secrecy. A meeting of the staff (clinical and non-clinical) and postgraduate students may be called.

The clinician-in-charge of the case reads out the history, findings of clinical examination, and the results of various routine and special investigations undertaken during the life of the patient.

The antemortem data are laid open for discussion. Other clinicians from the same and other specialities try to give a diagnosis trying to explain the available clinical data. The clinical data are thus thoroughly analysed for finding clues to the underlying pathological process. At the end the pathologist reads the post-mortem report including the histological studies. He demonstrates the pathological specimens and histopathological slides. In con-

Out of the twenty-six centres of learning in India, fourteen replies were obtained. In a majority of centres there is no separate course for otolaryngology, while two places have courses for six months each and at two places there is some kind of a syllabus.

The teaching is done by clinicians in collaboration with the basic scientists. More often, the student picks up his own reading. Outside India the student gets extensive training in these subjects. In the United States and Canada the resident is attached to the basic department.

In England the Royal College of Surgeons conducts a course every few months, for three months.

Considering the great disparity of teaching in basic sciences and pathology in our country, there is a great need for uniformity of standards of training of the future specialists. Uniformity cannot be had unless a fixed required time, to be spent on the teaching of basic sciences and pathology, is specified. This would be easy if a definite residential course is instituted. The time should not be less than six months and the student may not spend any of his time on the clinical side during this course. The course should preferably be after one year of house job. This course should include the following main disciplines.

1. Embryology:

Development of face, nose, nasal chambers, paranasal sinuses, palate, tongue, tonsil, larynx, thyroid, bronchial tree, oesophagus, mediastinal contents, external ear, middle ear, inner ear, arterial system of head and neck.

The lectures should be applied and the clinical importance of the abnormalities of development must be stressed.

2. Anatomy and Histology:

Anatomy and Histology of external ear, middle ear, inner ear, detailed study of labyrinth, nerve supply and arteries, veins, facial and auditory nerves—their central connections. Anatomy of temporal bone and its relation. Section of temporal bone. Dura and dural venous sinus, the cranial nerves.

Anatomy of face, nose, structure, nasal chamber, para nasal sinus, nasopharynx. Eustachean tubes adenoid, lips, tongue, teeth, tonsils palate, larynx, tracheobronchial tree, oesophagus and its sphincteres. Contents of the mediastinum and thoracic cavity. Muscles of respiration, diaphragm thyroid, parathyroid.

Nerve supply, arteries and veins of neck. Detailed study of the lymphatic system of head and neck and chest.

Time must be spent in the department of anatomy and there must be dissections on cadaver.

TEACHING OF BASIC SCIENCES AND PATHOLOGY IN OTOLARYNGOLOGY

YOGINDER N. MEHRA, M SC. (MC GILL), F.R.C.S. (CANADA), D.A.B.O.

THE teaching of basic sciences and pathology to the postgraduate students of otolaryngology varies greatly in different places in India according to a survey conducted recently. A circular was sent to all the heads of departments of otolaryngology in India where postgraduate courses (both M.S. and D.L.O.) are conducted. This included the following medical institutions:

1. Andhra Medical College, Maharampetra, Visakhapatnam.
2. Guntur Medical College, Guntur.
3. Osmania Medical College, Hyderabad.
4. Assam Medical College, Dibrugarh.
5. Darbhanga Medical College, Bihar.
6. P. W. Medical College, Patna.
7. All-India Institute of Medical Sciences, New Delhi.
8. Lady Hardinge Medical College, New Delhi.
9. Registrar, Medical Faculty, Delhi University.
10. B. J. Medical College, Ahmedabad.
11. Medical College, Baroda.
12. Medical College, Trivandrum.
13. M. G. M. Medical College, Indore.
14. Christian Medical College, Vellore.
15. Stanley Medical College, Madras.
16. Madras Medical College, Madras.
17. Armed Forces Medical College, Poona.
18. Great Medical College, Bombay.
19. Topiwala Medical College, Bombay.
20. Medical College, Amritsar.
21. S. M. S. Medical College, Jaipur.
22. G. S. V. N. Medical College, Kanpur.
23. K. G. Medical College, Lucknow.
24. Medical College, Calcutta.
25. Institute of Postgraduate Medical Education and Research, Calcutta.
26. Institute of Postgraduate Medical Education and Research, Chandigarh.

Similar circulars were also sent to some of the well known centres of otolaryngology training in Sweden, Holland, Denmark, Germany, Great Britain, U.S.A. and Japan.

In the questionnaire the following information was sought: *The duration and syllabus of the course of basic sciences and pathology and whether the time was spent in the basic departments.*

Neoplasia, classification-benign, malignant common type, modes of spread of malignant tumours, metastasis, morphology and metabolism of tumour cells, aetiology, precancerous state.

Systematic pathology: General principles of pathology of all systems.

Special emphasis on: Respiratory system, trachebronchial pathology, gastrointestinal system, oesophagus stomach, blood forming system, endocrine glands, skin, bones.

Special detailed pathology: External. middle and inner ear, inflammation, acute and chronic, cholesteotoma, infections, degeneration, tumours, extension otosclerosis.

Nose and paranasal sinnuses, disorders.

Throat, lips, teeth, gums, tongue, tonsils, palate pharynx, hypopharynx, nasopharynx, larynx, oesophagus, neck swelling, thyroid parathyroid, salivary glands, major and minor, lymphatic system, nervous system in relation to E.N.T. inflammation, intracranial complications of otolaryngic pathology,

Tumours of cranial nerves, 8th nerve, pituitary disorders, disease of duramater, dural venous sinus.

Orbital disorders

This is a very detailed programme and there are very few departments of basic sciences where facilities for teaching these are available. This teaching will have to be done both by the clinicians and basic scientists. At most of the places the anatomists and biochemists can give training in their respective fields. However quite a few fields require the help of a specialist, i.e. the otolaryngologists with special training to conduct the courses. Considering the shortage of otolaryngologists in the teaching institutes, we may say that there is very little likelihood of the improvement in the situation unless we take help of the available talent from different quarters. This is possible if the teachers take part in a course like the one which is offered by the American Academy of Ophthalmology and Otolaryngology. This is a postal course where a student is given a list of reading material and every month he is sent a question paper on a particular field, e.g. anatomy and embryology. The student consults the material at his disposal and posts the answer to the question to a set of examiners who assess the paper and give the correct answer and send it back to the student During the postal course of ten months there is an extensive coverage of the subject. About 30 specialists and basic scientists can look after the programme. A student is charged nominal fees to cover the postage. The specialists give free service. I feel such a programme is feasible and can be adopted until we can afford to have good departments of basic sciences and the pathology of otolaryngology in India.

The pathologists can also prepare microscopic slides with descriptions which can be posted to the student.

Each department must make endeavours to give the student experience on cadaver surgery and otomicrosurgery so that the risks of having to deal with inexperienced surgeons is obviated.

Larynx. Theories of phonation and physiology of vibration. Speech disorders.

Hearing and its mechanism theories. Hearing tests, tuning fork. Pure tone audiometry. Speech audiometer. Special audiometry. Vestibular function. Laws of interpretation. Rotational tests, caloric tests of nystagmus. Electronystagmography. Its uses.

4 **Principles of Anaesthesia:**

Hypothermia, Cardiac arrest. Blood transfusion. Reactions.

5. **Pharmacology:**

Antibiotics, chemotherapeutic agents. Local anaesthetic and their complication. Nasal decongestants vasodilators, corticosteroids, chemotherapy of cancer and cytotoxic drugs. Prolonged and regional perfusion.

Fungicides: Antihistamines, Histamine release substances.

6. **Microbiology:**

General outline of bacteriology and virology. Special study of diphtheria, viruses, Autoimmunity, *Immunization effects on ear.*

7. **Applied Surgery and Biochemistry:**

(i) Normal values of biochemical data.
(ii) Water and electrolyte balance
(iii) Broad outline of kidney, liver, spleen, adrenal functions.
(iv) Transplants, skin, cartilage, bone homo-auto pathophysiology.
(v) Blood transfusion—reactions.

8. **Pathology:**

A specialist is as good as his pathology.

It is very essential that the student should get the maximum contact with pathology.

General Pathology

Principles of pathology: Inflammation, repairs, regeneration, necrosis, acute inflammation, chronic inflammation types, relation to amyloidosis.

Physical injuries, radiation reaction, tissue reaction to radiation, chemical injuries.

Infectious early phase, establishment dissemination, inflammatory reaction, endocrine reaction, pyrexial reaction, leucocyte reaction, immunity. resistance, hypersensitivity.

Allergy· allergic diseases, infectious diseases, connective tissue disorders.

Local metabolic histochemical and nutritional lesions.

Fluid and blood disorders, vascular, ischaemia embolism, infarction, thrombosis, haemorrhage, shock oedema, electrolyte disorders, coagulation disorders.

Hypertrophy, atrophy.

Morphological adaptation to functional requirements.

Heredity, growth senescence.

Congenital malformation.

With this curriculum and short time, is it possible for a candidate to submit a thesis worth the name?

Several times the words 'thesis' and 'dissertation' are used loosely to mean tbe same thing.

THESIS

A thesis means a subject for seholastic exercises especially one preserihed for a doctorate. It must be of a high standard and must contain theoretical generalisations and solutions of surgical problems that make a notable contribution to the practice of oto-rhino-laryngology. Is it possible for the over-burdened candidate to submit any original work that could produce generalised solutions for the scientific medical problems?

This situation is created because the undergraduate does not have sufficient aequaintanee with this speciality. So a person who is intending to be trained for M.S. should have a thorough and accurate knowledge of the abovementioned subjects beginning from the fundamentals. So the M.S. candidate has enough work in the short time of two years to master many branches of the speciality. Hence he cannot pay adequate attention to the thesis.

Moreover for writing a thesis wbich requires the candidate to prove a bypothesis by faets, figures, and experiments, facilities in our institutions do not exist at present. Many institutions that train these candidates have not even facilities for animal experiments, reasonable laboratory facilities, hotb general and biochemical, not to speak of an electron mieroscope.

In many of the universities in India M.S. in oto-rhino-laryngology is the highest examination and a candidate when successful becomes a specialist or a consultant or holds the post of the head of a department in whieh case he is expected to guide and direct research students. Candidates who are trained in their study years to submit theses, dissertations, case records, etc. are more knowledgeable and suitable for the above posts, i.e. consulants, etc.

Therefore it may be asked if a candidate, who is to be trained in the routine work of the department and to do many major surgical operations and master operative techniques as well as subjects mentioned in the curriculum of basic sciences in a short time of two years, is in a position to produce a scientific thesis?

Yet it is necessary to have some sort of an essay in the syllabus for promoting scientific standards of the M.S. candidate. This may be a dissertation or twenty case records on the same topic or in groups.

DOCTORATE EXAMINATION (PH.D.)

In India there is plenty of scope for research both in basic medical sciences and in clinical surgery, but unfortunately researeb work in these subjects is meagre. Instituting a higher degree like Ph D. in a particular branch of surgical speciality will stimulate research-minded workers, teachers and other brilliant young men to take up this higher degree. In such cases a thesis of the above standards may be instituted.

If any speciality is to progress the only possibility is the workers in that field should take up research work on basic problems and produce generalised conclusions and solutions to many problems in the field. Hence introduction of higher degrees is an absolute necessity in this country.

THESIS OR DISSERTATION FOR M.S.

DR. C. SATYANARAYAN

THE postgraduate especially one who is taking the Master's Degree examination in oto-rhino-laryngology should be trained in anatomy including embryology, pathology including micro-biology, physiology including bio-chemistry, audiology including elements of sound in addition to the clinical, theoretical and surgical aspects of oto rhino-laryngology.

The examination should encompass all phases of oto-rhino-laryngology including broncho-oesophagology, maxilo-facial surgery, and surgery of the neck and also of basic sciences:

1. Applied anatomy of the ear, nose, throat, neck, chest and oesophagus—including the related nervous system and embryology.
2. Physiology including bio-chemistry.
3. Gross pathology, histo-pathology and micro-biology.
4. Clinical examination of the patients (history taking physical examination, functional tests, discussion of differential diagnosis, laboratory and X-ray data, etc).
5. Operative techniques of all routine major and minor operations including emergencies

AIM

A candidate must be able to write an essay, report a case and in future should be able to take charge of an E.N.T. department, become a teacher and researcher, etc. He must in all cases be capable of rendering specialist service in ear, nose and throat diseases.

Is it a thesis or a dissertation or case record, and discussion with conclusions, that is necessary for a candidate appearing for a master's degree examination in oto-rhino-laryngology in order to fulfil one of the above requirements?

EXISTING SYSTEM

In this connection, a word about the existing system is not out of place. In most of the universities in India the highest postgraduate examination offered for an oto-laryngologist is M.S., i.e. master of surgery in E.N.T. though one or two universities offer a doctorate (Ph D.) in oto-rhino-laryngology. The curriculum necessary for the M.S. examination has been postulated as in the above paras. The time that is spent for the M.S. examination is never more than three years after passing the degree examination and finishing the general house-surgeoncy in one year.

In Madras university the first year is compulsorily spent for the diploma (D.L.O.) examination after the house-surgeoncy of which six months are in general surgical side. Out of the two years, considerable time is spent in the first year for general surgery training and examination. There is one year left, in which a candidate should be trained either for the above curriculum or to be an expert in the procedures of otolaryngology. These candidates are our future consultants, heads of the units, professors, and research scholars.

METHODS OF ASSESSMENT

DR. P. NARASIMHA RAO, M.S., F.I.C.S., F.A.C.S.

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AN examination is a test of certain behavioral changes which are brought about by the process of education. "It is not a sudden doomsday visitation out of the natural fruition and fulfilment of a long period of educational preparation and growth." There is really no basic dichotomy between instruction and evaluation. The latter is an integral part of the former. It is not a mere measurement of the information which the student possesses which may be assessed by a paper and pencil method. It is not a recall of facts and figures but an assessment of a candidate's ability to interpret them when they are presented to him. The important thing then is his scale of values and his capacity for judgment in the light of these values. Of course there is a relationship between the extent of information in a field that one has and intelligence to use that information to think correctly. The Radhakrishnan Report and a Report of the Committee of Experts on Indian Examinations have gone into this question very thoroughly and have suggested that the old methods of essay type examinations often lead to incorrect assessment of the candidate's intrinsic worth. An examination is meant as a systematic endeavour by experts to determine whether a student, at the end of his training, has acquired the necessary knowledge and dexterity in his subject. It is an incentive to the student for preparing his subject, providing him with an opportunity to make sure of his facts and master his knowledge and develop a faculty for critical judgment.

The postgraduate degrees in medicine, like other advanced degrees in the different fields of sciences or humanities, are intended to carry the student to the highest level in the particular branch of study and endow him with a capacity to think out and investigate in the realms of knowledge opened out for his mastery. Course work and thesis work are therefore combined judiciously to bring about this result. Examinations generally consist of theses, dissertations, written, practical and oral work. Each method has its advantages and disadvantages. The thesis or dissertation can reveal an intensified application of the student in a limited field of specialisation and his capacity for elucidation and inference can mark out the standard of his judgment. This work must be done under supervision, as otherwise one cannot find out that the work was performed independently. But it carries no guarantee against unlawful assistance since there is no check against such deception. The dissertations ought to be of an independent work. The student must himself select the subject, although he could discuss with the teacher the possible themes. Written examinations do not take into account individual differences and their inflexible form allows much room for chance and encourages learning by rote.

In the evaluation and measurement of students' learning the academic examinations with the essays on selected topics have been found to be defective as they do not bring out the

DISSERTATION

Dissertation means a formal or elaborate or argumentative discourse or discussion or essay or treatise. Dissertation must also have a standard suitable for the M.S. degree. A candidate's dissertation must present new scientific and practical conclusions and recommendations. In several of the university examinations dissertation means writing an answer to a long question in the theory examination. It does not therefore serve the purpose. But if on the basis of discussion between the candidate and the examiner a particular topic is chosen for a dissertation it may be of value.

CASE RECORDS

In many of the universities a candidate has to produce records of 20 cases studied by him personally or 20 major operations personally conducted or assisted by him or a topic containing a consolidated report with critical evaluation.

The case records may consist of several different cases, i e twenty different operations which give the candidate an opportunity to study the technique and master twenty operative procedures and discussions about the diagnosis, differential diagnosis, the choice of treatment. And if the candidate takes twenty cases of the same kind he finds an opportunity to produce a thesis or dissertation having scientific conclusions and generalisations.

A thesis, or dissertation or cases records, must be submitted well in advance—at least four months before the examination—to the examiners.

Finally I leave it to the wisdom of this Conference to decide about the choice of a thesis or dissertation.

into the attitude of the student towards his teacher. What is naturally the freest of all relations can easily be tinctured with shrewd calculation. The fear of examination in many cases needlessly increases the student's dependence. If on the other hand examinations are conducted entirely by men who are practically engaged in the professions, then examination would become mere inquiries into what are currently accepted as true. A man whose time is given to the practice of his profession will not, as a rule, be able to keep up with the rapidly advancing scientific work. Hence it is desirable that both should have a place on the Examination Board. It would be the business of the latter to emphasise the requirements of professional education and practice, and that of the former would be to emphasise the necessity for scientific culture or, better still, to give the candidates an opportunity to show, each in his own way, what they can do either in one direction or the other. The main thing will, therefore, be to find out what the candidate can do and what he knows, and not what he cannot do and what he does not know.

An examination should be conducted so that a candidate can get an opportunity to reveal his strong points as well as his limitations and deficiencies. It would be desirable therefore to ask the candidate to tell first what he knows. Such a course would also give an opportunity to gain an insight into his attitude toward the subject, and into the character of his work and his conception thereof. The candidate would thereby also be assisted in overcoming initial difficulties and would obtain confidence in his examiner and gather courage for his task. Then the examiner might ask questions in order to ascertain the extent and limits of the candidate's knowledge. It would be a very faulty method indeed if the examiner, without first getting into touch with the candidate, begins to ask at random all kinds of questions or deliberately tries to make the candidate conscious of his deficiencies. So far as the form of the question is concerned, it must be definite and intelligible, not general, ambiguous, and puzzling. A couple of questions properly answered at the beginning increase the candidate's confidence, while the missing of a few questions will make him lose confidence and easily awaken the ill-humour and impatience of the examiner. The bearing of the examiner should be friendly and courteous and should neither intimidate nor repel an examinee.

There are idealists who maintain that the love of knowledge should be the student's guide, not the examination and its requirements. It must never be forgotten that the pursuit of science for its own sake and preparation for the examination are two entirely different things. It is possible to understand a subject thoroughly without being able to pass an examination and, conversely, it is possible to pass an examination in a subject without really understanding it. The true student will love his science, and pursue it as if there were no such thing in the world as an examination, and this is right and proper; but on the other hand, the well advised student will not neglect to find out betimes what is required in an examination.

A circular letter was addressed to all the Principals of Medical Colleges requesting them to furnish information regarding the scheme of examination for the diploma and degree examinations conducted by their universities. Only ten replies were received. An analysis of the method of assessment followed in the universities indicates that the diploma examination is conducted in two parts and consists of Theory, Clinical, Practical and Oral examinations. Marks are awarded for the answers. The scheme of examination for the degree of Master of Surgery

student's ability to organise and present ideas about a topic. They only reveal bis capacity to remember. Several objective type examinations have come into vogue, which can measure not only knowledge of facts but ability to analyse and interpret, synthesise and evaluate. Objective measurement is a tool of real education. It reveals the principle and philosophy of the subject; stimulates high levels of reasoning required in inference and organization of ideas; enables a wide coverage of a subject (as many questions as can be answered within a reasonable time). Finally it is more reliable because larger samples of the students' learning are made accessible Students are enabled by it to have a broad background knowledge rather than a mere study of a subject. It helps students to study throughout the year rather than at the time of examination. Too much reliance on two or three broad questions is thus eliminated and along with that the element of chance which more often than not plays bavoc with markings and gradings.

The oral examination has the greatest freedom for it gives the examiner an opportunity to distinguish between superficial and genuine knowledge of his students. This method, however, may give rise to prejudice, giving scope for unjust treatment and judgment. The practical examination affords an opportunity to judge the knowledge and also the dexterity of the candidate The advantage of combining all these methods of examination need not be over-emphasised.

But an examination, however foolproof, does not infallibly reveal whether the candidate has sufficient education. Everybody knows how much room there is for chance and luck even in a serious and well-conducted examination. Nor is the influence of what may be termed the personal factor less important. There are those who know how to make much out of a little and understand the art of "putting the best foot forward," who make a better display in an examination than their knowledge warrants. On the other hand, there are the thoroughly prepared and competent candidates who never appear in a worse light than in an examination—embarrassed, easily intimidated and confused, persons who lose control of themselves at the critical moment, whose memory fails them and whose judgment seems to be paralysed. The personal factor in the examiners also looms large; ability to quiz, to listen, to understand, to appreciate, differs widely with different persons. Even the most expert and just examiner cannot guarantee a perfectly just judgment. All this implies that the examinations by no means supply the candidates with the complete assurance that competence and merit will be decisive in the final result. Just as the patronage system does not necessarily favour the incompetent, the system of examinations does not necessarily favour the most competent. Nothing in human affairs is absolute. But we cannot and do not, on that account, desire to give up the system of examination. Though they are imperfect, we have nothing better and the most competent have the best reasons for wishing to have the examinations continued and earnestly conducted. They accomplish much good by preventing evil.

Who shall conduct examinations? The university professor or the medical practitioner? The professors know what the candidate has learned and the candidates know what their teachers think is important; and there is no doubt that such knowledge makes the taking of examination much easier. For example, examination depends less upon chance. There is also another side to this matter. The prospect of the examination introduces a disturbing element

consists of Thesis or Dissertation, Theory, Clinical, Practical and Oral examinations. Some universities have general surgery as a separate part while in other universities general surgery forms part of a special subject. I am of opinion that principles of general surgery should form an important part of the examination for the award of the Master's Degree.

The present system of examinations has been evolved over many years of "testing" for its usefulness. The reform, if any, can be introduced only by the Examination Board which is constituted by professors with long teaching and examination experience. The setting of question papers and technical and research evaluation require people trained in the art of evaluation. It is no doubt a subjective art but the background of experience enables an individual to evolve a high degree of objectivity, reducing the personal factor. The university must give as much attention to the process of examination as to that of teaching. Then the examination can be made a part of educational training, and it will lose its terrors for the student, and be looked upon as providing an occasion for evaluation of knowledge, which would enable a candidate to distinguish himself.

professor or a teacher, and two registrars. The ancillary staff should include an audiologist, two audiometricians, two speech therapists, and adequate laboratory technicians and clinical staff. A department of this size may have at one time up to six postgraduate students.

Besides routine diagnostic equipment, the department should have an operating microscope, a dental drill, audiometers, and units for ultrasonic therapy. Adequate space should be available for the clinical and laboratory instruction of students, including sound-proof rooms and rooms for otoneurology and speech-therapy. A good departmental library is essential, as well as a good Medical Records Department.

acoustics including principles of sound and audiometry; and clinical training including diagnosis and management of ear, nose and throat disorders.

METHODS OF TRAINING

It was suggested that little emphasis should be laid on didactic teaching. More useful than lectures are demonstrations on basic science subjects and clinical problems, seminars, group discussions, symposia, journal clubs and clinical-pathological conferences. Inter-departmental consultations and conferences with allied departments such as radiology and neurology should form an essential part of the training programme. Cadaveric and animal surgery as related to the temporal bone and endoscopy, etc. should be practised.

THESIS OR DISSERTATION

A thesis or dissertation should form part of the M.S. course in otolaryngology. The object of this will be to train the candidate in research methodology by engaging him in a research project. The thesis should be submitted three months before the final examination and should be accepted before the candidate is eligible for the examination.

A higher standard of research achievement should be expected from the Ph.D. students.

EXAMINATION AND ASSESSMENT

Objectivity should be the basis of the method of assessing the thesis or dissertation, written, practical and oral tests. Examinations should be given by one internal and two external examiners.

The D.L.O. examination should be conducted in two parts. Part I should relate to a basic science examination, including anatomy, physiology, therapeutics, bacteriology and pathology in relation to otolaryngology and acoustics. It should be held at the end of six months' training. Part II should consist of clinical examination on diseases of ear, nose and throat. It should be held at the end of one year's training.

The M.S. (Otolaryngology) examination should also consist of two parts. Part I, given at the end of one year's training, should cover principles of general surgery. Part II given after two years of training should cover basic sciences and medicine and surgery in the practice of otolaryngology. A candidate should be eligible to take Part II of the examination only after he has passed the first part.

The candidate who has already passed the D.L.O. examination will have to undergo the same training and examinations as other M.S. candidates.

A regular record of a candidate's day-to-day work as related to his clinical laboratory and other teaching exercises should be maintained and duly certified by his teacher. This should be taken into consideration in the final assessment.

INSTITUTION REQUIREMENTS

A department of oto-rhino-laryngology accepting candidates for the D.L.O. and M.S. (Otolaryngology) should have at least 39 beds and a faculty staff of one professor, an assistant

(*c*) The facilities of various medical colleges for postgraduate training will need a check-up.

(*d*) The major specialities should be given the status of an independent department, with proper rules and regulations for collaboration and co-ordination with other disciplines to guarantee academic freedom and to ensure the smooth working of the various units.

(*e*) Apart from lectures and clinics, regular periodical clinico-pathological seminars, conferences and demonstrations should be arranged in every institution for the benefit of the post-graduates.

(*f*) Emphasis should be laid on follow-up of cases and proper statistical units with full facilities for record-keeping.

(*g*) Departmental libraries and research room facilities are badly needed.

(*h*) It is common experience that the postgraduates do not have proper residential accommodation during their training period. Both for the internees, house-surgeons, and post-graduates suitable arrangements must exist and also good remuneration so that they may be entrusted with patient care and graded responsibility in the hospital. All postgraduates should receive a State scholarship for their maintenance. After the training is complete, jobs may be ensured for them by the State or States concerned.

(*i*) It may be suggested for consideration that as soon as the candidates pass the M.B B.S. examination they all be employed by the State, and after due selection, they may be posted in various hospitals as well as for postgraduate training.

(*j*) As a part of this training programme exchange of teachers in India may be organised. The universities should be approached to sanction duty leave or special casual leave to the teachers in medical colleges to attend professional conferences and to conduct examinations, which does not obtain, by and large, today.

(*k*) The administration of teaching hospital needs special attention as the rules of admission of cases, provision of accommodation for clinics, seminars, tutorials, organisation of operation threatre, rehabilitation units, etc. require a comprehensive and co-ordinated effort. There is a difference in the set-up of a district hospital as compared to a medical college hospital, and as such this slant is called for.

(*l*) There should be an agreed schedule of training, with enough laxity to the various institutions to evolve patterns of teaching in a particular subject without any regimentation. Special centres may be recognised for particular subjects. Major specialities like Radiology, Anaesthesia, Gynaecology, E.N.T., Orthopaedics, Ophthalmology and Pediatrics should have independent postgraduate degrees. The co-ordination with allied branches may be worked out and completed by rotating postgraduates for definite periods of time.

4. TEACHING OF PATHOLOGY AND BASIC SCIENCES IN THE CURRICULUM

It is agreed upon that the training in basic sciences is essential in view of the advancement in various subjects under medicine. The points for consideration are:

(*a*) Should there be a full-time training for specified periods in different subjects, or should it be a part-time training in collaboration with the clinical departments, when the candidate is working in the institution?

POSTGRADUATE TRAINING IN ORTHOPAEDICS

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1. METHODS OF SELECTION AND REQUIREMENTS

ALL the graduates who have obtained their degree of M B B.S after having completed their rotating internship and have completed their compulsory housemanship, as laid down by the Medical Council of India, will be eligible to apply for postgraduate education in different subjects. To choose from amongst them the following points need consideration:

(*a*) Their M.B.B.S. record and the remarks of the teacher regarding their work and interest as house surgeons or its equivalent in the pre-clinical or para-clinical departments.

(*b*) Provided that the candidate has done at least one year's internship or housemanship for clinical subjects or an equivalent job in a non-clinical recognised institution approved by the Faculty of Medicine.

(*c*) The selection of candidates should be made on an all-India basis so that deserving candidates find a place in any State medical college after proper scrutiny and interview by the authorities concerned.

2. DURATION AND CONTENTS OF COURSE

In most of the universities at present the candidate has to put in two years of work in a particular department after having completed one year of his housemanship. It has been suggested that another year be added at the postgraduate stage so that the postgraduate may have a full-time training in basic sciences It has to be decided, and needs the serious consideration of the members, whether this addition of one more year is essential. The financial implications for the candidate and the urgent need of the various States in the country for more specialists has to be assessed in arriving at a conclusion. Whether our present-day specialists with a three-year training have justified themselves so far or not needs assessment.

3. METHODS OF TRAINING

(*a*) It needs emphasis to appreciate that in any modern speciality training collaboration with different departments and an integrated full-time course is essential. The candidates are required to attend the various departments in the medical colleges and it is essential to decide beforehand the various subjects which should be particularly taught to a group of postgraduates going in for a particular course.

(*b*) The most important need at present is to increase the teacher-student ratio. No training programme can be a move towards the ideal that we wish to achieve unless the number of teachers is increased, particulary in the specialist departments.

DURATION AND CONTENTS OF COURSE

DR. B. MUKOPADHYA

Patna

THE content of the course of studies for the Master's degree in Orthopaedic Surgery will depend on the objectives to be achieved from such a training programme. Simply stated our objective is to produce a potentially reliable and competent surgeon in the best sense of the term with as much specialised experience as possible, which is required to execute the procedures applied to the problems of Orthopaedic Surgery, and by this concentration of experience in a well defined field, to enable him to exercise judgement on matters uncommon to the mere general practitioner. The aim of training is not merely to produce a craftsman skilled in the execution of certain complicated and difficult procedures. To be a good surgeon today one must have a thorough background in the basic medical sciences and also a full appreciation of the scientific basis of modern surgical practice. Without such a basis, clinical training cannot be imparted on a dependable foundation. The training programme must also attempt to inculcate certain habits in the trainee. It must develop powers of clinical observation, of logical analysis of facts and sound judgment, of hard work, of familiarity with scientific literature, of critical study of literature and the ability to analyse the status of present-day knowledge so as to grasp the opportunities of research.

Postgraduate training must be looked upon as an extension of undergraduate training and cannot be planned in a vacuum. It must take cognizance of what has been achieved at the undergraduate stage. The deficiencies, if any, of the undergraduate training course must be made good before the superstructure of postgraduate training can be built up on a sound foundation. In recent years, there has been a tendency in India to look upon orthopaedic surgery as a postgraduate subject largely as a result of the somewhat outmoded recommendations of the Indian Medical Council to the detriment of undergraduate education. Consequently, medical graduates of today enter a postgraduate course in orthopaedic surgery without any grasp of the basic fundamentals of this broad, important and comprehensive section of surgical practice. This must be remembered while planning the course of studies.

Orthopaedic Surgery has been defined as that section of medical practice which is concerned with the prevention and treatment of the injuries, diseases and disabilities of the motor-skeletal system comprising limbs and trunk. Its practice overlaps not only allied surgical disciplines but also the fields of medicine, gynaecology and obstetrics. There is another aspect to be considered. Although modern surgical practice is essentially a scientific discipline its application to an individual patient still remains an art. Surgery cannot be taught in the class-room. It has to be learnt as an apprentice under the guidance of a master with graded responsibility shared by the trainee. The training programme must provide such opportunities.

The training should start with a course of instruction in the basic medical sciences. The anatomy of the motor-skeletal system must be covered in much greater detail than it is done

(b) Should there be a part one examination in the basic sciences, or should it be combined into one examination at the end of the training? Should the basic science teacher be associated with these examinations and, if so, in what form?

(c) Should the candidate be previously certified by the various basic science departments before he is allowed to take up the final examination in a speciality?

5. THESIS OR DISSERTATION AS REQUIREMENT

(a) The preparation of the thesis is a very good training for a postgraduate who gets an opportunity of becoming thorough in the study of a subject. This is also a stimulus to establish research laboratories and select projects for intensive work with the help of the teachers, technicians and the facilities in the institution. This requirement of a thesis is a good one and needs encouragement.

(b) The dissertation is the next alternative depending upon the facilities which are meagre for a thesis. Attempts should be made to establish proper research units in postgraduate institutions to obtain the atmosphere of preparing a thesis.

6. METHODS OF ASSESSMENT

At present the assessment of a candidate is made in various universities either by having a Part I examination in basic sciences, in collaboration with the physician or the surgeon, or by having one final examination by the physicians or the surgeons concerned with a particular speciality. In the latter case there is one internal examiner and two external examiners.

(a) It is important to realise that, whatever method of assessment is introduced, depends upon the integrity and the proper selection of examiners. Should there be a panel of examiners on an all-India basis, who may work by rotation, or should some rules be laid down for the selection of the examiner, is a matter for discussion.

(b) A record of day-to-day work and the remarks of the teacher regarding the interest of the postgraduate in his work should be available in every postgraduate department. This should be considered at the time of the final assessment.

(c) The quality of the thesis or dissertation even if approved should be taken into account at the time of the final assessment.

(d) The details of the various sections of the postgraduate examination should be laid down so that there is some parity in the method of assessment on an all-India basis.

(e) Whether it would be desirable to have some period of training for the examiners in the different subjects by associating them with the college and university examinations is a matter for consideration. In the present stage of our development of various new medical colleges, the teachers need an opportunity for making themselves up-to-date in the art of assessment. How are we going to introduce this is a matter for this conference to decide.

grasp the importance of the knowledge gained from the basic subjects in its application to the problems in orthopaedic surgery, and this co-relation should be constantly emphaphasised by the teachers.

Clinical clerkship should be selective but not exclusive. The candidate should have access to all the different surgical disciplines and may spend a fair amount of his time with what is commonly called 'general surgery' but which is in fact largely visceral surgery. Thus will he be able to get a complete grasp of the whole field of surgical action and appreciate the intimate contacts which exist between basic sciences and clinical disciplines.

This period of course should always be a wholetime course, the trainee attending hospital *practice in the morning* and *class room and dissection room instruction in the afternoon. If* a daily work schedule of 6 to 8 hours is drawn up, it will be possible to complete the course in one academic year quite easily. It is essential for this period of training to be wholetime because then alone with the trainee be free to parcel out his time in a planned manner to obtain the maximum benefit from the course. During this period he is not really being trained in details of practical technique. He can, however, assist in the operations and such assistance will cover the whole field of surgical action. Therefore he will be fully and comprehensively trained.

There should be regular and periodic assesment of the candidate's work and at the end of the courses of instruction there should be a test and each candidate should be given credit on the basis of periodic tests.

Only a candidate whose performance is considered satisfactory and of sufficient excellence, should be allowed to pass on to the next stage of the course. These assessments should be conducted jointly by the basic science teachers and clinical teachers who may include any or all the teachers of the various surgical diciplines.

The second part of the course should be devoted entirely to orthopaedic training. This should be in the nature of apprenticeship. The trainee must work in an orthopaedic department *under a recognised teacher. This will give him the experience to exercise judgment* and also an opportunity to master practical techniques. The course of instruction should consist of:

(*a*) Didactic lectures.
(*b*) Clinical demonstrations.
(*c*) Operating work in operation theatres.
(*d*) *Seminars.*
(*e*) Journals club.
(*f*) Death reviews.
(*g*) Follow-up clinical discussion.
(*h*) Interdisciplinary case conferences.

The trainee must attend out-patients, emergency, ward work, record-keeping, pre- and post-operative management. He must be given graded responsibility.

The instruction must include the following broad areas of orthopaedic practice:

(*a*) Orthopaedic pathology.
(*b*) Fractures, sprains and dislocation—traumatic orthopaedics.

at the undergraduate stage. There should be facilities for each candidate to perform a full dissection of the limbs and spine. A careful and thorough dissection of the spine is essential for an orthopaedic trainee This part of the dissection is usually neglected in the undergraduate course. Anatomy must be taught in a three-dimentional perspective Spinal anatomy must include anatomy of all structures related to it. A thorough mastery of osteology and neuro-muscular anatomy forms an essential foundation of the practice of orthopaedic surgery. Embryology and morphology, specially in relation to the development and evolution of the limbs and spine, must be covered. Such knowledge is essential for a proper understanding of the problems of body balance, locomotion and many clinical orthopaedic conditions.

The course in physiology and bio-chemistry need not be very exhaustive but the physiology of muscle action, of the central and peripheral nervous systems of body fluids, of vitamins and minerals, of endocrine organs, must be covered comprehensively. The details of the course have to be worked out in the light of the changing pattern of our knowledge of physiology and bio-chemistry.

The course in pathology *should include only general pathology and bacteriology with special* reference to the bacteria responsible for orthopaedic infections

The speed with which new and potent pharmacological agents are being added almost daily to our therapeutic armament makes it imperative that the trainees should be given a course of instruction in pharmacology. It will not be wrong to say that knowledge of pharmacology of practising clinicians tends to be based more and more on commercial literature and not on the publications in learned journals. This makes it all the more imperative that the trainees receive up-to date informations on these subjects from teachers who can be fully alive to the scientific advances in their special fields. The instruction in pharmacology should include anaesthetics, analgestics, hypnotics, antibiotics, chemotherapy, corticosteroids, tranquilisers and such other agents as are in daily use in orthopaedic practice.

One word regarding the organisation of these courses of instruction. They must be arranged in co-ordination with the orthopaedic teachers. An ideal arrangement will be one in which both groups of teachers participate so that the students receive the benefits of the experiences of both. It will not only help the students but the teachers as well and will help to bridge the gulf.

It is during this period that the trainee should receive instruction in the fundamental principles of surgical *practice*. These *are to* be *presented as extension of what they have already* learnt at the undergraduate stage. The course should cover the subjects of history of surgery, basic surgical techniques, haemorrhage, shock infusion, transfusion, electrolyre balance, tissue injury and tissue repair, tissue transplantation, pre- and post-operative care, complications, clinical assessment of patients, surgical infections, tumours, principles of radiotherapy, and others. This will present to the trainees a comprehensive picture of surgery and will enable them to *obtain a clear insight into the problems* common to all surgeons. It will also enable them to visualise the importance of the different surgical disciplines and their inter-relationship and the areas where they overlap.

It is essential that along with the courses of instruction in basic medical sciences, the candidates continue to receive training in clinical surgery. Then alone will they be able to

(c) Cold orthopaedics.
(d) Radio diagnosis of bone and joint diseases.
(e) Physiotherapy and rehabilitation.
(f) Brace-making and Prosthetic technique.

Beside these, during this period the trainee should be expected to prepare a dissertation on a subject of his choice or to perform research on a subject, the work being embodied in the form of a thesis. This will enable the candidate to learn how to study the literature on a particular subject and also get acquainted with the methodology of research.

The details of the course to be covered during this part of the training are given in the appendix.

Two years should be adequate to cover this part of the course.

Summary:

Duration:—3 years.

1st year:—anatomy, physiology, general pathology, bacteriology, bio-chemistry and pharmacology.

2nd & 3rd years:—orthopaedic pathology, orthopaedic radiology, traumatology, orthopaedics, physiotherapy and rehabilitation and research.

Cold Orthopaedics:

1. Congenital deformities.
2. General affection of the skeleton.
3. Infections of bone and joints exclusive of tuberculosis.
4. Tuberculous infections of bones and joints.
5. Chronic arthritis including arthritis of individual joints—non-specific.
6. Neuro-muscular disabilities including infantile paralysis.
7. Affection of the knee joint.
8. Affections of the ankle and fore-arm.
9. Affection of the neck and shoulder.
10. Affection of the elbow, wrist, hand and jaw.
11. Tumours and tumous conditions of bones, joints, muscles, tendon and fascia.
12. Affections of the spine and thorax.
13. Affection of the low back.
14. Affections of the hip.

Fractures and Joint Injuries:

1. General consideration.
2. Repair of fractures.
3. Principles of fracture treatment.
4. Complication of fractures.
5. Open fracture and war wounds.

III. *Medical Specialties Pertaining to Rehabilitation Medicine:*

Physical modalities.
Orthopaedic surgery.
Neurosurgery.
Orology.
Neurology.
General medicine.
General surgery.
Pediatrics.

IV. *Application of the Principles of Rehabilitation Medicine:*

Rehabilitation of the patient with musculoskeletal problems.
Rehabilitation of the patient with disease of muscular and neuromuscular systems.
Rehabilitation of the patient with neurological disorders.
Rehabilitation of the patient with cerebral palsy.
Rehabilitation of the patient with poliomyelitis.
Rehabilitation of the patient with paraplegia and quadruplegia.
Rehabilitation of the patient with cardiovascular diseases.
Rehabilitation of the amputee.
Rehabilitation of the patient with pulmonary diseases.
Rehabilitation problems of children.
Geriatic rehabilitation.

METHODS OF TRAINING

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ORTHOPAEDIC surgery occupies a unique place among the subjects classified as specialities in that its scope is far more general than that of the other regional specialities. Although the speciality started as one dealing with deformities in children as the words 'ortho' and 'paedios' imply, its modern scope has however extended to include all diseases and injuries of locomotor system in children as in adults. The increasing use of surgical methods in the treatment of these conditions has changed the name of the subject from orthopaedics to orthopaedic surgery. It is still essential to remember that the major portion of the treatment is by non-surgical methods such as manipulation, splinting and re-education of the musculoskeletal system to restore full function.

Training

In the postgraduate training in orthopaedic surgery emphasis should be given to the following aspects:

Duration. In my opinion the total period of training should extend to three years. During this period the student should be attached to the department of orthopaedic surgery.

The training programme should include the following subjects:

1. Basic Sciences:
   Anatomy, Physiology, Biochemistry, Biophysics.
2. Paraclinical subjects:
   Pathology, Bacteriology.
3. General surgical training.
4. Children's Orthopaedics.
5. Adult Orthopaedics.
6. Traumatology and emergency fracture service.
7. Physical Medicine—Brace and Limb Workshop.
8. Rehabilitation of the physically disabled—Rehabilitation Centre.
   Vocational Rehabilitation.

During the period spent in studying anatomy, the candidate should be made to revise his knowledge of aoatomy in the dissection hall with emphasis on the locomotor system. He should also he made to do all the surgical procedures of the various regions and thus get a thorough knowledge of surgical anatomy.

A knowledge of basic physics with emphasis on electricity is necessary to understand many of the equipments used in physical medicine. Any study of the biochemical problems in the locomotor systems needs some understanding of the principles of physics as applied to human body. The more receot methods of investigation of electrical potential changes such as electromyography need a knowledge of basic electronics Hence it is very necessary that the candidate attends a few lectures and demonstrations in biophysics and electronics.

The candidate should he attached to the department of pathology for a period of three months. In addition to attending postgraduate lectures, he should he made to do the routine work of reception of bone pathology specimens from the orthopaedic department, section cutting and preparation of slides. He should join the pathology staff in discussions and reporting of slides. He should get all the clinical data about the specimen and he the liaison man. Sueh an in-serviee training makes him understand the procedures and difficulties in the pathology department whieh will help to bring about better co-ordination of the two departments. In the orthopaedic department the candidate should be trained in the management of all the routine fraetures attending as out-patients.

During the seeond year the eandidate should be hrought into increasing contact with surgieal work in general and with that of allied clinical departments in particular. Work in a general wards trains him in the maoagement of common surgical emetgeneies and cases of hurns, tetanus, and other general infeetions. The trainee should spend about 3 months in general surgical wards and one month each in neurosurgery, plastic surgery and thoracic surgery departments. These are branehes whose work overlaps with many regional conditions which an orthopaedic surgeon has to deal with He should also spend a month each in the radiology and pediatric departments.

During this period, he should also work in the physieal medicine and rehabilitation departments to get well acquainted with various rehabilitation procedures used in physiotheraphy and occupational therapy. He should he quite well trained in the assessment of orthopaedic cases and the prescription of various therapeutic modalities in physical medicine.

The accurate assessment of cases of poliomyelitis and prescription of the proper types of orthopaedic appliances can be learnt only if the candidate learns about the fabrication of various types of braces, etc. hy working in the hrace shop attached to the orthopaedic department. At the end of this year the candidate should appear for Part I examination in basic sciences and general surgery.

During the third year of training the candidate should work in the various sections of the orthopaedic department and obtain in-service training. In the out-patient department he should be given responsibility to run the fracture clinic, orthopaedic clinic aod physiotherapy clinic under the supervision and guidance of the professor. He should become confident in the reduction and post-reduction management of all out-patient fractures. In the orthopaedic clinic he

should learn the routine of investigations, diagnosis and disposal of all cases and put up for discussion cases of academic and clininal interests.

In the in-patient section the candidate should work in the childeren's ward and adult wards by turns under the supervision of the qualified assistant. In his final year he is given increasin responsibilities of ward management. The preoprative investigations and preparation of cases and their post-operative management will be learnt by him by taking actual responsibilities for the cases.

In the training for orthopaedic operative work, emphasis should be placed on the extra rigid aseptic precautions to be observed in the pre-operative preparations, operative techniques and post-operative care. He should be thoroughly conversant with the "No Touch Technique" of operations and the uses and risks of the tourniquet. Progressively increasing responsibility in operative work should be given during the third year of training.

The educational programme should consist more of practical instruction in ward rounds, staff conferences, seminars and case discussinn at the clinics rather than of didactic lectures. It is very essential that the candidate is made to present cases for discussion in clinical meetings of the hospital. This gives him thorough training in the art of investigations and writing up of cases after consulting.

Clinicopathological Conference

Clinicopathological conferences play an extremely useful role in the training of postgraduates. Such conferences between the orthopaedic department and the departments of pathology and radiology should meet periodically to discuss important and interesting cases with the pathology slides and specimens. An understanding of the clinical, pathological and radiological features of disease entities is very instructive.

Seminars, Journal Reading and Literature Survey

The trainee should be given excercises in the form of search for literature regarding certain selected subjects and write short papers. Periodic departmental seminars are held where the candidate is made to present the paper and then made to answer questions from the other postgraduates. The professor plays the role of an observer and acts as a guide in the discussion.

Attendance at Conference

The postgraduates should be encouraged to attend at least one annual or regional orthopaedic surgeons' conference during their training period. This brings them into contact with other senior surgeons and they become familiar with varying viewpoints of other surgeons on the subjects.

Undergraduate Teaching

The training of a postgraduate in orthopaedic surgeory should not only deepen his knowledge of the subject but also broaden his outlook and shape him to become a surgeon as well as a surgical teacher for the future generations of students. As such he should be associated in the teaching programme for the undergraduates. Teaching helps in the better understanding of the subject and trains him in coherent expression of ideas to an audience. The trainee should be made to make clinical demonstrations to undergraduate students who are posted in the department.

The trainee in orthopaedic surgery should be made aware of the work done in the community by voluntary agencies for the vocational and economic rehabilitation of the physically handicapped. This makes him realise the role he has to play in future to guide and co-operate in such activities.

STUDY OF BASIC SCIENCES FOR SPECIALISATION IN SURGERY IN GENERAL AND IN ORTHOPAEDICS IN PARTICULAR

DR. M. L. CHATTERJEE

THE importance of basic sciences in the proper study and understanding of the clinical subjects has been appreciated by one and all and repeatedly emphasised. But the integration of the study of these with the study of the clinical subjects has not been feasible at the undergraduate level for practical reasons. On the other hand, the paraclinical subjects have frequently enjoyed somewhat better integration with the study of clinical subjects because opportunity frequently exists or is created for joint "discussion methods of teaching," seminars, etc.

It is our experience that by the time the undergraduate is ready for the final M.B.B.S. examination, or shortly after graduation, he forgets most of the facts and figures he carefully studied for his first M.B.B.S. examination.

For the postgraduate student the problem is somewhat different. He has to become a specialist and, therefore, has to study, learn and properly understand the details of all knowledge and research observations in that particular discipline. To facilitate this, the knowledge of the basic sciences is essential. "Surgery so far as it is a science at all, is a Biological Science. The surgical patient is a Biochemical problem. We aim now just as often at correcting disordered Physiology as at correcting disordered Antomy" (Aird-1960).

It may be asserted that a renewed and careful study of basic sciences is a "must" before the basic doctor is considered fit for higher study and for taking a postgraduate examination in any of the surgical specialities. The basic sciences should be taught by recognised teachers of these disciplines in collaboration with their colleagues of the surgical department by arranging occasional seminars and joint discussions. The candidate should be examined by both clinical and non-clinical teachers. Only the successful candidates should be eligible for taking the mastership or the diploma examination.

This principle is now receiving almost universal support in most parts of the world. Such an examination is known as "primary" for the fellowship examination in the U.K. and Ireland. It is known as "Part-I" Examination in many Indian Universities and similar examinations known as "diploma in basic sciences" in the Calcutta University where it is a pre-requisite qualification for the master's examinations and all diploma examinations of the Calcutta University.

form, function and growth potentiality. For the purpose of traumatic surgery and orthopaedic surgery, including surgery of congenital malformations, a thorough knowledge of osteology, syndesmology and myology will be indispensable for obvious reasons. Surface anatomy is as important for orthopaedic surgery as it is for any other speciality. The importance of angiology for the cardiovascular surgeon, of neurology for the neuro-surgeon, and of splanchnology for the general surgeon needs no special mention.

"Anatomy is to Physiology as Geography is to History. Much of Physiology is an account largely in terms of Chemistry and Physics." (Samson Wright.) Outstanding knowledge in physiology and bio-chemistry has been gained recently. Only when we know the normal functioning of the cell, of the tissues, and of the organs of the human body are we placed in a position fit for the study of normal reactions and morbid physiology in response to trauma, infection and other abnormal stimuli. In this way we proceed gradually from a study of physiology on to a study of pathology. They are intimately linked together. Similarly, physiology is inseparably connected with bio-chemistry. Physiology, therefore, forms a solid foundation on which the structure of the scientific study of medicine stands.

Knowledge of pathology enables us to study and recognise the aetiology and pathogenesis of diseased states of tissues and organs. By obtaining a thorough knowledge of the pathological states in a tissue it is possible to understand and explain many of the clinical features. Pathology, thus, is an unavoidable step leading to the accurate diagnosis of all diseased states. A strong presumptive diagnosis can often be arrived at by going carefully into the history of the illness, complaints of the patient and results of pathological investigations of blood, urine, sputum, body fluids, aspiration and biopsy materials. Radiology is a great help at this stage for confirmation. Autopsy examinations help us in further studies of diseased tissue for better understanding and application of knowledge in future.

A doctor, specially a basic doctor, must be well-versed in the use of common medicines. It is equally desirable that a specialist should also be equipped with a basic knowledge of drugs. When a patient comes to a doctor he should be considered as a suffering human being as a whole, and not as a case. Although the surgeon is primarily concerned with surgical conditions, he cannot afford to be mechanical. He must be capable of using appropriate medicines for the relief of common symptoms of the patient without the help of a physician, and as a supplementry to the operative treatment.

Success of surgery is very definitely dependent on pharmacology. Knowledge of the medicines that are in every-day use is essental, for example, such medicines as muscle relaxants, steroids, antiseptics, basal narcotics, hypnotics and analgesics.

Diagnosis will be difficult and sometimes impossible in the absence of the knowledge of vitamins and hormones and the part they play in deficiency diseases. Without the knowledge of chemo-therapy, antibiotics, anaesthetics and blood transfusion, modern surgery would have been impossible. Unless one is conversant with the pharmacological basis of actions, reactions and side effects of drugs, treatment may not only fail to produce the desired result but it may occasionally do harm to the patient.

Conclusion

The following conclusions may be arrived at:

1. The study of basic sciences is essential for higher study and specialisation in surgery, including orthopaedic surgery.
2. Teaching should be done by the recognised teachers of those disciplines, in collaboration with their clinical colleagues if possible, and examination by them.
3. Only successful candidates will be eligible for postgraduate examination whether it is the diploma or the master's degree.

away from the main work. The material is easily available and the student is required to study and follow the cases which he is actually looking after, during the terms of his study. This study will give him a proper training and ample scope at the compilation of an article, which will stimulate interest in the collection of materials for publication of articles.

GUIDANCE AND PLACE OF WORK

All are unanimous that dissertations should be prepared under the guidance of a professor, having at least 4 to 5 years of teaching experience in the subject. It is also agreed by all that the dissertation can be prepared only in a teaching hospital attached to a medical college in the same university. The majority favours the submission of the dissertation four months prior to the examination, some want that it should be submitted one year before the examination. The candidate must be informed at least four months before the examination whether his dissertation is accepted or not. Though no candidate will be allowed to sit for the examination unless the dissertation is accepted, when a thesis is rejected the reasons for rejection should be indicated. Such a candidate should be permitted to submit a revised dissertation and if that is accepted he will be permitted to appear for the final examination that very year. If his dissertation is rejected the second time he will have to wait for one year.

There should be no separate examination on the dissertation.

PERIOD REQUIRED FOR THE PREPARATION OF DISSERTATION

Opinions vary on this point. Irrespective of the duration of the course a few feel that a dissertation must be submitted a year ahead of the final examinations while a few others are content that it is presented at the time of the examination. Most, however, favour the presentation of the dissertation four months prior to the final examination. This appears reasonable.

The duration of the course in some universities is two years and in some three, but considering the economic conditions of our country, it is better to keep the period as two years only. During this time he must be fully engaged in the department, attending night duties, emergency calls, assisting operations and operating independently and following post-operative cases, etc. If the period is lengthened to thee years the candidate may have to be allowed to do part-time paid work to sustain himself.

TIME OF INTIMATION

It is felt however that a dissertation should be promptly reviewed and the decision communicated within a month of its presentation. An opportunity should be given to the candidate to rewrite the manuscript and resubmit it a month ahead of the examination: if the dissertation is then acceptable the candidate should be allowed to take the final examination, otherwise he should do it in the following year.

The consensus of opinion is that there should be three examiners for the correction of the dissertation: one is the internal examiner under whom the dissertation is prepared, the two others being the external examiners.

It is also accepted by all, save one, that the same examiners who conduct the rest of the examination, i.e. correction of theory paper and conducting of clinical and oral examinations, should also correct the dissertation.

THESIS OR DISSERTATION AS A REQUIREMENT IN ORTHOPAEDICS

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FOR the preparation of this paper, every endeavour has been made to seek the opinion of a majority of the orthopaedic surgeons, so that the views expressed in this would be acceptable to the majority. Eighteeen orthopaedic surgeons have responded to my questionnaire. Even though all have not replied, I was able to get some opinions from most of the orthopaedic surgeons who are conducting the postgraduate courses in orthopaedics. Hence this can be taken as fairly representative of all the universities.

All the teachers are in favour of a thesis or a dissertation being a requisite for the postgraduate course in orthopaedics, but there is a difference of opinion as to the choice.

THESIS VERSUS DISSERTATION

By thesis is meant the preparation of a paper on a problem, with the aid of laboratory experiments on animals or human beings. By dissertation is meant a study of cases of the same type or of different types, numbering from 12 to 20, with a short review of literature on each.

At present, the writing of a thesis is a compulsory requirement in some universities. Five out of 18 teachers have replied that preparation of thesis is their present practice Some of them favour replacing the thesis by a dissertation because of:

1. Inadequate facilities, such as laboratories, experimental surgery, etc
2. The thesis demands more time for its preparation than does a dissertation and takes a big slice out of the time meant for clinical work and other training.
3. The quality of work is poor for lack of guidance from overburdened teachers.

Some teachers suggest that whenever a candidate produces a really good thesis, he may be exempted from a part or whole of theory examination. This to me is not desirable, because the candidate has probably mastered a particular subject by concentrating on it, but what about the rest of the orthopaedics, which he must know. This concession defeats the purpose of the theory examination, which is to ascertain whether the candidate has a grasp of the whole subject and not one particular area.

I support the suggestion that the work on a thesis may be started after M.S., and for this credit may be given when occasion arises.

DISSERTATION

Fifteen out of eighteen postgraduate teachers prefer a dissertation of 20 case studies to a thesis because it can be prepared while the student is undergoing clinical training without taking him

is not available for the postgraduates, it is too much to expect of them to bear the cost of the postgraduate education extending over a period of six years in addition to time already spent in the undergraduate education.

Assuming that the recommendation of the orthopaedic section of the Association of Surgeons of India that there should be a postgraduate course for the Master's degree in orthopaedics will be accepted by the authorities concerned, let us now consider the methods of assessment of the performance of the postgraduates throughout the course. It is essential that there should be periodic assessment of the work of every candidate by the respective teachers and at the end of the first year there should be a university examination in basic sciences and principles of general surgery. It is advisable to co-opt an orthopaedic specialist with the examiners in basic sciences and principles of general surgery to avoid unnecessary hardships for the examinees. There may be one theory paper of three hours in each of the following subjects: anatomy, physiology including biochemistry, pharmacology, pathology including microbiology, and principles of general surgery. A clinical examination consisting of one long case and three or four short cases may be held by a general surgeon together with an orthopaedic specialist. *Viva voce* examinations in all the five subjects may be held. Unfortunately, at present due importance is not given to assessment of *day-to-day* work of the candidates and further the marks awarded for this work are not always taken into account during the university examinations before deciding the results.

In our opinion not less than 25 per cent of the total credit should be given to the candidate's day-to-day work before deciding the result of each candidate at every university examination. It is indeed a great pity that we are at present leaving the fate of every candidate to the vagaries of one university examination instead of depending on the average of many tests during the whole course.

Now to consider the methods of assessment in the main subject of orthopaedics, we would like to stress the importance of holding periodic tests both in theory and clinical throughout the two years' course and give due credit to the candidate's performance in these tests when his final result is decided at the time of the university examination. Since a separate paper has been written on the subject "Thesis or Dissertation as Requirement," we do not propose to deal with this aspect of assessment. With regard to the theory papers in the university examination the consensus of opinion is in favour of three papers of the duration of three hours each. In some of the universities one paper contains two questions on large subjects and the candidate is required to write an essay on one of the two subjects for three hours. In our opinion this will give an idea to the examiner whether a candidate has grasped the salient features in a large subject and has the ability to arrange his facts in an essay form. It will also promote his assessment of the various methods of diagnosis, treatment, etc.

M.S. DEGREE COURSE IN ORTHOPAEDICS : METHODS OF ASSESSMENT

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IN our country, rightly, or wrongly, we have always given great importance to examinations. In the existing circumstances, examinations may be considered by many as a necessary evil. For quite some time we may not have an adequate number of competent teachers who can not only give proper training to postgraduates but also assess their day-to-day work as satisfactory from every point of view so as to do away with examinations altogether. In most European nations, four to six years of training in orthpaedics under a recognised teacher is necessary before one becomes a specialist. As a rule, the postgraduates do not have to pass any special examination at the end of their training. In the United Kingdom, however, the *University of Liverpool* awards the degree of *Master of Orthopaedic Surgery (M.Ch. Orth).* In the United States the postgraduates undergoing training in orthopaedic surgery have to pass two examinations. The first examination in basic sciences may be taken at the start of the training in the speciality of orthopaedics. The second examination which is only in orthopaedics should be taken four years later. Three years' residency in orthopaedic surgery in a reconised intitution is essential.

In our country we are facing special problems in postgraduate medical education in general and in various specialities in particular. It is beyond the scope of this paper to discuss whether, in the present economic conditions in our country, it is desirable to insist on every postgraduate who wishes to specialise in orthopaedic surgery to secure a Master's degree in general surgery before registering himself for the Master's degree in orthopaedic surgery. As a matter of fact, at the August 1964 Conference of the Orthopaedic Section of the Association of Surgeons of India, it was unanimously decided that after completing one year of house surgeoncy in addition to the compulsory rotating house surgeoncy (internship), every postgraduate must undergo three years of training in an institution recognised for postgraduate training in orthopaedics before he is permitted to appear for the Master's degree in orthopaedic surgery of the respective university. It was decided that the first year should be spent on learning basic sciences and principles of general surgery and the remaining two years should be devoted to orthopaedics. At the end of the first year there should be an examination in basic sciences conducted by teachers in the respective subjects with the co-operation of an orthopaedic specialist and another in principles of general surgery by a general surgeon with the co-operation of an orthopaedic specialist. It must be admitted that the period of three years is too short to produce the competent and mature orthopaedic specialist which one comes across in U.K. or U.S. A., where the total period of postgraduate training extends over six years or more. However, since an adequate number of suitable posts or scholarships

REPORT OF THE SUB-COMMITTEE ON ORTHOPAEDICS

PROF. B. N. SINHA

Chairman and Head of the Department of Orthopaedic Surgery, Medical College, Lucknow

PROF. P. K. DURAISWAMI

Rapporteur and Director, Central Institute of Orthopaedics, Safdarjong Hospital, New Delhi

INSTITUTION REQUIREMENTS

CERTAIN prerequisites should be fulfilled to ensure proper standards of training. The teacher-student ratio and the bed strength in every training centre should be approximately increased. The orthopaedic department should be given the status of an independent department with full academic freedom. There should be proper collaboration and co-ordination among the different disciplines to ensure smooth organisation and implementation of the training programme. There should be adequate facilities for a departmental library, for maintenance of records, secretarial assistance, including the services of statisticians, and a proper follow-up system There should be adequate residential accommodation for all postgraduates during the training period. All postgraduates should receive either stipends or study leave with full pay, if in service, for the stipulated period of training. To improve standards there should be exchange of teachers among various orthpaedic centres. The exchange should be encouraged by giving leave and financial assistance. A similar programme should be instituted for the postgraduate students also. The administration of teaching hospitals should be run in such a way as to aid the teaching and training in orthopaedics.

METHOD OF SELECTION AND MINIMUM REQUIREMENTS

All registered graduates with M.B.B S. degree approved by the Medical Council of India are eligible, provided they have completed one-year housemanship or an equivalent post in a recognised pre- or para-clinical department approved by the Faculty of Medicine for this purpose and provided their academic record and testimonials from their teachers regarding their work and aptitude are satisfactory. All candidates should be selected on merit preferably following an interview.

DURATION AND CONTENTS OF THE M.S. (ORTH.) DEGREE COURSE

The course should be full-time for three years The first year of training should be in the pre-clinical, para-clinical and allied clinical desciplines organised by the orthopaedic department in collaboration with the departments concerned. The remaining two years should be in-service training in the ortbopaedic department.

on the differential diagnosis rather than on the actual diagnosis of the case. Our experience is that some candidates blurt out the correct diagnosis on incorrect physical findings.

Coming to the practical examination, it is not possible in certain centres to secure enough cadavers for examinees to perform operations on them. Even if one or two cadavers are available they are generally so shrivelled that no operations can be performed. The consensus of opinion among the examiners is that this can be replaced by a *viva voce* examination on the indications and essential details of operative techniques as well as on dissected specimens. This should be followed by a *viva voce* examination on (*i*) pathological specimens, (*ii*) histological slides, (*iii*) *intruments, prosthetic and orthotic appliances*, and (*iv*) *roentgenograms.*

The total number of examiners and the proportion between the number of external and internal examiners vary from one university to another. This does not really matter so long as the examiners know for certain the standard that is expected of the candidates to pass the examination. If the suggested methods of assessment are combined with proper selection of postgraduates in every university the present high percentage of failures among the postgraduates can be avoided.

METHODS OF TRAINING

The basic part of the training should be in the management of emergency cases, graded responsibility in the pre-operative and post-operative care of patients and the performance of operations under supervision. The students should familiarise themselves with the methodology of research. They should learn the techniques of total rehabilitation which include physiotherapy and occupational therapy. Apart from didactic lectures and bedside clinics, regular autopsy and clinico-pathological conferences in collaboration with other disciplines should be arranged. Reviews of journals should be made. The students should be trained in the maintenance of records and follow-up of cases. They should also be given responsibility in undergraduate teaching.

ASSESSMENT AND EXAMINATION

Due importance should be given to the assessment of the day-to-day work of the candidates at the final examination. The thesis should be accepted as a method of assessment. Where proper facilities for research are lacking a dissertation should be accepted instead of a thesis.

Part I examinations should be held at the end of the first year in the following subjects: anatomy including embryology, physiology including biochemistry, pathology including microbiology, pharmacology and fundamental principles of surgical practice. There should be theory and oral examinations conducted by the orthopaedic department in collaboration with the other departments concerned. Part II examination at the end of the three-year course should consist of theory, clinical, practical and oral examinations on all aspects of orthopaedic surgery and rehabilitation. No candidate should be permitted to appear for Part II until he has passed the Part I examination.

It will be desirable to have an all-India panel of examiners in the speciality to ensure uniformity of standards in examination and assessment.

DIPLOMA COURSE

The method of selection for the diploma course should be the same as for M.S. (Orthopaedics) degree course. The duration of the course should be one year full-time with necessary adjustments made in the method of training and contents of the course. No thesis or dissertation should be required. Assessment should be made on the basis of a university examination in theory, clinical, practical, and oral.

SELECTION CRITERIA

Selection of candidates for speciality training must take note of, first, the specialist requirements of the community; secondly, the role these specialists have to play; and, finally, their aptitude and previous contact with the speciality.

It is generally accepted that for anaesthesiology we need two types of training: (1) a short duration training lasting 12-18 months, with greater emphasis on practical training and leading to the diploma in anaesthesiology, and (2) a more elaborate exhaustive and longer period of training lasting 2-3 years with bias towards academic work, exposure to methods of research and teaching and advanced type of speciality work, leading to the degree of M D. in anaesthesiology. The criteria and methods for selection to these two categories, therefore, shall of necessity vary as the role which these specialists have to play differs. The suggested methods of selection are:

A. For Diploma in Anaesthesiology:

(i) Possession of a medical degree from a recognised university.

(ii) One year's post-internship house appointment in the departments of medicine or surgery or anaesthesiology.

Clause 2 above can be relaxed if the candidate possesses not less than one year's practical experience in administration of anaesthetics in a hospital with not less than 50 beds for surgical patients or surgical specialities, or has been graded as a specialist in the Armed Forces, or has personally, on recorded occassions and duly certified by head of the institution, administered not less than 200 anaesthetics out of which at least 50 should have been for major surgical procedures.

B. For higher qualifications (M.D. Anaesthesiology):

The role of these specialists will be to hold senior hospital service or junior teaching appointments. It is not intended to equate them with those who wish to train for M.S. in general surgery. Whereas the degree of M.S. in India qualifies a young doctor to receive further training in surgery (just like those who obtain F.R.C.S. from the U.K.) so those who qualify for the award of M.D. (Anaesthesiology) are more or less finished products and full grown specialists. These specialists should have attained a fairly high standard of proficiency and with credit be able to head the anaesthesiology departments in medium-sized institutions. With this fundamental difference in their role, I have always felt that criteria for selection as defined for training for M.S. in surgery cannot be applied to those wishing to train for M.D. (Anaesthesiology).

Whereas one can accept for M.S. training a bright fresh product who has passed his M.B. with a high percentage of marks and some distinction, after a year's house job, I find it difficult to change such a candidate into a full-fledged specialist who unlike M.S. in surgery does not begin his true specialist training but has reached a maturity in training to stand on his own and play the role of a full specialist. With this in view I suggest the following criteria for selection for M.D. (Anaesthesiology) training.

(a) A medical degree from a recognised university, not less than 2 years prior to commencement of training.

(b) Completion of professional training with not more than two failures in his entire medical career.

(c) Experience of a house appointment in surgery, medicine or anaesthesiology for not less than one year.

(d) Diploma in anaesthesiology from a recognised institution on production of satisfactory evidence of having held for not less than six months the post of anaesthetist in a recognised hospital.

DURATION AND CONTENTS OF COURSE

If the criteria suggested above for selection are rigidly followed a uniformity can be suggested in respect of duration of course. It is felt that for diploma the duration of course should be one calendar year. This period will be adequate to cover both the theoretical and practical parts of training.

For M.D. (Anaesthesiology) the duration of course should be two or three years depending upon whether the postgraduate is a full-time student or is a staff member of the institution where he is registered. It is naturally not possible for a staff member to devote as much time to his training as a full-time student can. The former has to accept the full service load of the department, routine and emergency. It is felt that a full-time postgraduate will perform selected type of work and be relieved two or three times a week from routine theatre schedules to work at his thesis and attend morning teaching programmes. The departmental postgraduate will have less free time for such a study.

It cannot however be adequately stressed that the periods specified should be spent *in toto* by the postgraduate at the institution where he is registered. To spend a few months and even that irregularly and carry out thesis work and the major part of the training outside the Institution is not conducive to organised work and progress.

CONTENTS OF COURSE

Anaesthesiology entails a detailed study, not only of the speciality itself but also of several allied sciences. Anaesthesiology has wide and close contract with several basic and clinical sciences and it is felt that the course should broadly cover the teaching of the following subjects. Some of these can be covered by normal talks, some by bedside and theatre discussions and demonstrations and yet others by well designed seminars with or without participation by other disciplines. It is naturally impossible to cover the entire field of training by any tailored course. As a specimen. I suggest the following contents of course for M D. (Anaesthesiology). To suit individual problems we may introduce changes.

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(iii) Other basic disciplines like physics, pathology, microbiology and medical statistics should be included in the training programmes in so far as they concern the anaesthetist. Twenty-six well-designed lectures on each of these topics will mostly cover the needs. Some of these can be delivered by teachers of the respective departments. A working knowledge of medical electronics covering the equipment employed for monitoring in the operating theatres should be covered by a biophysicist or an electronics engineer.

B. Clinical Sciences

(1) Clinical sciences as related to anaesthesiology. These should include essential topics as they concern the anaesthetist in respect of the following specialities.

(a) General Medicine including medical assessment of the surgical patient.
(b) General Surgery including pre-and post-operative care.
(c) Elements of Cardiology including diagnostic procedures.
(d) Endocrinology.
(e) Radiology of common respiratory and cardiac diseases.
(f) Pediatrics.
(g) Neurology and Neurosurgery including essentials of e.g.
(h) Psychiatry with emphasis on emotional behaviours and essentials of medical hypnesis.

(2) Anaesthesiology—various aspects of anaesthesiology including history, various types of anaesthetic equipment, agents, gases and techniques and anaesthetic procedures for various specialities must be covered in nearly 200 lectures/tutorials/lecture demonstrations and seminars.

In view of the shorter period of training and greater emphasis on practical aspects of training for diploma course, the contents of the above course can be reduced to nearly a third by suitable adjustment. The progress of training has to be a dynamic one and a review of the material and methods has to be continuously applied to suit the everchanging patterns of medical education.

In addition to the above contents of course, efforts must he made to inculcate in the post-graduates the habit of self-study so that they engage in wide reading not only of standard text-books and monographs but also of journals of their own and allied specialities.

METHODS OF TRAINING

It is true that the final goal of good training is the benefit that can accrue to humanity. This is even more true of anaesthesiology, where decisions howsoever momentous have to be instantaneous. There is no time to discuss, consult or obtain a second opinion during an anaesthetic problem. For this reason, more than any other, good practical training must form the hard core of methods of training in anaesthesiology. Not that it is desired to detach the

academic side of training, as research in a broader context forms as much a part of human service as the routine hospital service.

I feel, for diploma in anaesthesiology, greater stress must be laid on aspects of training that produce an anaesthetist capable of administering a safe anaesthetic for routine service. Emphasis must be laid on a practical approach to the problems. By demonstrations, daily practice and table/side discussions more can be learnt than in the class room. Side by side with practical training, demonstrations and case discussions there should be a well designed course of lectures and seminars on various topics. The topics should include basic and clinical sciences as related to anaesthesiology in addition to anaesthesiology.

For M.D. in anaesthesiology, it is naturally impossible to design a course which should be broad and wide enough to cover all aspects of the speciality. Much of the reading of literature and standard books in the speciality and the allied sciences will have to be done by the postgraduates on their own. It is, however, necessary that adequate guidance should come from the teachers and postgraduates encouraged to prepare selected topics for presentation in departmental conferences.

At the All-India Institute of Medical Sciences, the first institution in this country to start M.D. in anaesthesiology, training is broadly conducted on the following pattern.

During the two years of stay in the department the postgraduates attend the routine clinical work including lists from speciality departments in the morning hours. The postgraduates are detailed for theatre duties under a staff member to assist and conduct various operating lists including major anaesthetic problems. On two mornings they perform their experimental and emergency duties along with staff members and take active part in the management of patients in the intensive care unit and those with cardiological or respiratory problems. During the clinical work they are also associated with pre-anaesthetic assessment, management of pain problems, recovery room and respiratory unit. The clinical experience gained by the postgraduates, therefore, does not restrict itself to the routine administration of anaesthesia, but gives them a much broader perspective by which they participate in various medical and surgical problems such as care of the comatose patients and those with circulatory, respiratory and pain problems.

The afternoons are mainly devoted to organised teaching. Two days a week, prepared talks are given on topics announced well in advance. Some of these topics are presented by the senior staff members and others by the postgraduates. A postgraduate is usually assigned a topic once in 3 months and is given 4-6 weeks for its preparation and, whenever a topic is assigned to a postgraduate, a senior staff member is nominated as moderator. The moderator has to guide the postgraduate with prepration and presentation of material and to cover the points requiring further clarification. In addition to the prepared talks, students attend a weekly meeting for the staff and postgraduates of the departments of cardiology, cardiac surgery, anaesthesiology and radiology. In addition a weekly 'poor risk' conference is conducted by the department of anaesthesiology, where postgraduates and teachers of the department and of other allied disciplines discuss problems of cases awaiting surgery. This teaching exercise is of great value and helps to develop a scientific approach to the medical assessment of a surgical patient. The discussions are recorded and, in addition to the immediate benefit,

agents and drugs which have a specific bearing on anaesthesiology. Physiology of respiration, circulation, endocrines, liver, renal function, central and autonomic nervous systems and neuromuscular transmission are some of the aspects. Similarly, pharmacology of anaesthetic agents and drugs having their application in relation to the above stated systems and organs should be included in the course.

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thesiology must have adequate knowledge and training to be able to cover important topics in basic disciplines by well-planned talks, demonstrations, seminars and visits to museums. In addition to the facilities available in the anatomy and pathology museums, the department of anaesthesiology should have a collection of anatomy and pathology specimens relating to anaesthesiology. These with descriptive literature could be displayed in the departmental museum along with charts, graphs, photographs and models. Many institutions have no facilities even for elementary teaching of biophysics and biometrics. These are important subjects for graduate students, even more so for those specialising in anaesthesiology. Part-time services of a physicist who has a bias towards medical physics and electronics can be of immense value. Many contributions to the postgraduate medical education in anaesthesiology have come from those departments which had on their staff medical physicists especially alive to the physical problems of anaesthesiology.

The next question that needs to be answered is how much of the basic sciences should be taught to postgraduates in anaesthesiology. Most universities try to answer this question by stating: "A knowledge of Basic Sciences as related to Anaesthesiology." This naturally leaves the details to the teachers concerned.

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Furthermore, as most basic sciences teachers are not fully conversant with the requirements of anaesthetists, it may be better to leave the assessment in basic sciences to the anaesthetists who can concern themselves more with aspects of basic sciences of everyday application to their speciality. The process of teaching and assessment in basic sciences as related to anaesthesiology is in fact a learning process by teachers in basic disciplines.

THESIS OR DISSERTATION

There exists considerable difference of opinion between educators on the question whether thesis should be a part of the examinations like M.Sc., M.S., M.D. Ph.D., or D Sc. or only for some of these examinations.

Till 1952 or so the only postgraduate qualification in anaesthesiology available in India and the United Kingdom was Diploma in Anaesthesia. A prerequisite for this examination was the production by the candidate of a proof of having personally administered a certain number of anaesthetics on recorded occasions, which included a certain number for major surgical procedures, and the examining board could demand a certified record of such work.

the department collects a good teaching material in the form of a "Poor Cases Library." At intervals, a review of the progress of departmental experimental projects is arranged. Teaching also includes posing of examination questions at intervals to encourage students to answer the questions in the most effective manner. Six to eight weeks before an examination a course for tutorials is arranged. Administration of anaesthetics, familiarity with anaesthetic equipments and anaesthetic techniques are thus a feature of the training programme. The students can interrupt the speaker at any time and ask for any clarification and the speaker too can ask questions. This has a great value, as the students come prepared. A monthly teaching calendar of the department is published in advance which covers anaesthesiology, basic and clinical sciences. This includes lectures, slides, seminars, demonstrations and specimen studies. Help is taken from various museums and basic science teachers for this purpose. A few talks are also arranged by the departments of endocrinology, biochemistry, radiology and cardiology to cover aspects of their specialities pertaining to anaesthesiology. The postgraduates are encouraged to give selected talks or lecture demonstrations to the undergraduates. The journal clubs are an important feature of the teaching programmes, where the postgraduates are given topics on which they review recent literature. The wider aspects of training include participation in inter-departmental seminars and discussions, presentation of case reports and papers at the speciality conferences. Each postgraduate is encouraged to be an author or a joint author of at least two papers during his 2-3 years of stay. These considerably widen his outlook and ability to look up references, review literature and present data in a scientific and effective manner.

TEACHING OF PATHOLOGY AND BASIC SCIENCES

Basic Sciences in the Curriculum

Impact of basic sciences on teaching of anaesthesiology has been particularly significant. It has been rightly stressed that anaesthesiology is based not only on clinical sciences but also on basic disciplines as anatomy, physiology, pharmacology, pathology and medical physics.

How much of basic sciences should be taught and by whom? Ideally this should be by teachers of the respective disciplines who by continuous process of learning and association with the teachers of anaesthesiology develop an appreciation of their needs

This is however not always possible. The basic science departments in addition to the load of undergraduate and postgraduate teaching are requested by numerous clinical departments for specially tailored courses in basic disciplines for clinical postgraduates. The department of anaesthesiology may, for example, approach the department of physiology to cover for them such topics as pain, consciousness, respiration, cardiac action, endocrines and the like. Similar demands may come from other clinical disciplines. It is naturally impossible to expect full training in basic sciences from basic departments. A satisfactory method can be evolved by designing an integrated course, comprising important and common topics which could be conducted by basic departments on an institutional basis each year. The topics selected should be of common interest to the postgraduates of different disciplines.

In addition to a wide-based common training programme in basic sciences, supplementation training will be necessary within the department of anaesthesiology. Teachers of anaes-

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supervisors who have had no exposure to methods of research and possibly they have no research publications to their credit. Some of them guide a score of theses each year, in addition to assessing several theses sent to them by other universities. It is natural that some of the theses thus produced are ill-supervised and ill-documented. What then, it may be argued, is the value or utility of the thesis which not only demoralises the candidate but also subjects him to barrassment, waste of time, material and money?

Those who support this view suggest that it would be better if instead of a thesis the candidate is taught methods of an intelligent clinical investigation, review of literature, search for references, diligent reading and analysis of his observations and a final appraisal of problems in anaesthesiology.

My personal views are contrary to this dark hypothesis. Research and investigation must not be confined to any one speciality, institution, community or a nation. It is true that every thesis is not an original research or contribution in the strict sense of the word. But a well-conducted, well-supervised study does unfold the hidden faculties of a future teacher. He is exposed to methods of research, to design an experiment, conduct it, analyse it, survey its statistical significance and honestly record his observations even if these may be negative ones. By this alone, he will teach his mind to grow and learn to develop powers of original thinking and ability to analyse and record critically.

We must not forget that a student may never get another opportunity to be initiated into methods of research and, if denied this chance, he may be in future like one of the present-day thesis guides. In progressive countries even the undergraduates are inpired to research by associating them with research projects during vacations, but in this country we are eliminating research even for the highest examination of our speciality!

I for one feel that every thesis must involve some laboratory work, howsoever minor part it may be of the entire project. A purely clinical thesis sometimes degenerates into a second-rate dissertation.

It is usually argued that we have no equipment, no laboratory facilities and the like. I do not believe that the solution of a problem lies in escaping from it. What really is involved is not the lack of equipment or facilities, but the desire to achieve and a concerted study. We have to make a start somewhere, sometime. In this context I feel that instead of lowering the standards of M.D. (Anaesthesiology) because some centres are as yet not well equipped to conduct research and guide theses, the institution of M.D. (Anaesthesiology) should be restricted to centres where such facilities exist.

Although it was not a thesis or a true dissertation, it did mean a record of the work of the candidates which gave an account of how cases were condncted by him.

The present pattern of diploma in anaesthesiology does not lay down such a condition either in India or in the United Kingdom and is based on the concept that being a practical test the examiners could assess the candidate's approach to daily problems effectively in the clinical and oral parts of the examination.

Subsequently some Indian universities started higher examinations in anaesthesiology, first in the form of anaesthesia as a special subject in such examinations as M.S. which subsequently developed into M.S. in anaesthesiology examination. The first to give the higher examination in anaesthesiology, i.e. M.D. (Anaesthesiology), was the All-India Institute of Medical Sciences although it did so after considerable initial hesitation. This has led to initiation of the M.D. in anaesthesiology examination in the universities of Lucknow, Bombay, Madras, Delhi, Osmania, and I understand some others are likely to amend the designation of M.S. (Anaesthesiology) to M.D. (Anaesthesiology).

Whether thesis is an essential part of M.D. (Anaesthesiology) depends upon whether a particular university demands this for other M.D. Examinations, e.g. M.D. in general medicine.

Varying patterns exist in different centres. Universities of A.I.I.M.S., Punjab, Lucknow end some others insist on a thesis. Purely clinical, laboratory studies or combination of both are acceptable.

Some others like Madras require a dissertation containing a study of 20 to 25 cases on a clinical problem. There exists a considerable difference of opinion whether the thesis must form an integral part of M.D. (Anaesthesiology) examination or this can be replaced by a dissertation or even by detailed records of 20 problem cases personally managed by the postgreduate. Perhaps the difference between a well-written dissertation and a purely clinical thesis is negligible. Yet another significant variation of the pattern of thesis exists in some centres, which try to achieve the near ideal by insisting that during the entire period of training the student must spend time under his supervisor. Before commencement, the study is planned, preliminary working obstacles are removed, equipment and laboratory facilities assessed and a brief protocol outlining the clinical and laboratory aspects of the study supported by a review of literature and references are submitted to the faculty of medicine within the 6 months of registration for assessment by clinical professors of the entire faculty before its submission for acceptance by the university. Only then does the postgraduate commence his work under personal guidance of one or more supervisors. On the other extreme, there are universities which accept on the recommendation of the specialty teacher the topic for a thesis at the time of registration and after some briefing the candidate is permitted to carry out the thesis study at his own place of work, sometimes hundreds of miles away from the place of registration. None the less the supervisor certifies before the examination that the entire work has been carried out under his supervision. In between these two patterns there exist other variants which include studies of problem cases, anaesthetic problems, and purely clinical or laboratory studies.

Those who argue against the submission of thesis assert that many centres do not have adequate staff and laboratory facilities for the guidance of thesis and some of the opponents of thesis are the ones who admit postgraduates in the greatest nnmbers. There are those

Two papers, one dealing with basic sciences relating to anaesthesia, and the other on clinical anaesthesia including related clinical sciences, followed by a clinical and an oral examination should form a satisfactory method of assessment for diploma in anaesthesiology. We must attempt to find the background of the candidate's practical approach to daily problems and to bring out what he knows.

(b) *For M.D. (Anaesthesiology)*

In the light of the background and development of the pattern of thinking that has emerged during the past decade, I feel that, in contrast to the D.A. Examination, here the stress should be on finding out what a candidate does not know pertaining to his own speciality and allied fields. The examination should consist of:

(a) Thesis
(b) Theory

4 Papers on:

(i) Basic Sciences in relation to Anaesthesiology
(ii) Anaesthesiology
(iii) Clinical Sciences as related to Anaesthesiology
(iv) Anaesthesiology—A review

The first three papers should have three questions each and the fourth paper should offer two topics out of which the candidate must select one for detailed presentation.

Clinical and Oral

(c) This includes discussion on long and short cases, anatomy and pathology specimens, X-Rays, e.c.g.s, and anaesthetic drugs and equipment including monitoring and research equipment and mechanical ventilators, etc. There should also be a *viva-voce* on several topics.

(d) Practical examination—the candidate may be asked to anaesthetise, preferably, one of the cases which he has critically examined in clinical examination.

(e) A brief extempore talk to a class on a selected topic, which is to be communicated to the candidate a few minutes before to enable him to organise his thoughts.

The board of examiners should preferably consist of three anaesthetists, one internal and two external examiners. There has existed at the All-India Institute of Medical Sciences a pattern of M.D. (Anaesthesiology) as outlined above for the past five years. This has been favourably commented upon by several exaperienced teachers.

METHODS OF ASSESSMENT

Are examinations a sound method of assessment? Are the few hours of contact between the student and his examiners adequate to assess a candidate? Should day-to-day assessment and performance wholly or partially be accepted in favour of annual examinations? These are all important points and this is not the forum to discuss them in any measure of detail. As things are the necessary evil of examination is essential to create and sustain the zeal and interest of the students.

Though it is true that in anaesthesiology practical training is to be emphasised, one cannot wholly divorce such training from theoretical knowledge. However, it is essential both in the interest of the community and the State that those who are labelled as specialists should not only be trained but should have also attained the requisite proficiency.

We often hear of widely varying standards of assessment in various centres. There are mental reservations in the minds of some who sit as expert advisors on various selection boards regarding veried standards. The only method by which to eliminate this disparity is to have a unified examining board of the highest integrity which could conduct at least the higher postgraduate examinations such as M.D. in Anaesthesiology. Selected institutions can train their candidates on a common pattern and the examination can be conducted by 2 to 3 examining boards appointed by a joint authority in a few selected and convenient centres. Such bodies as the Medical Council of India, Indian Academy of Medical Sciences and Indian Society of Anaesthetists, under the direction of the Union Ministry of Health, could perhaps function to fulfil this role. Papers written by candidates at their own centres followed by clinical, oral and practical examinations by one or more boards visiting specified centres seem to be a working proposition. Such a set-up exists in the U.S.A. for conducting examinations in anaesthesiology.

I have had the privilege to be an examiner in anaesthesiology for the past several years, both at the diploma and degree examinations in at least seven universities, apart from being an observer at speciality examinations in India, the U.K. and the U.S.A. At these what struck me most was the wide variations in standards of teaching and examination, the latter regarding both the performance of the candidate as also the examiner's performance. I feel the general pattern of assessment for anaesthesiology examinations should be as follows:

(a) *For Diploma in Anaesthesiology*

Universities should evolve and follow their own pattern. Since the bias is towards practical training the examination should take note of this aspect.

It should be adequate to have two examiners, both anaesthetists, one internal, from the university for conducting the examinations, and the other external selected by the university preferably from a panel of qualified teachers and examiners which should be continued by a central authority charged with the responsibility of conducting higher postgraduate examinations. At present most universities follow this pattern but some appoint a team of four examiners: two anaesthetists, a surgeon, and a physician. In some universities the panel of examiners is entirely changed after each examination, a process which does not lead to development of any standard.

METHODS OF SELECTION AND REQUIREMENTS OF POSTGRADUATE STUDENTS

DR. V. RAJAGOPALAN

Professor of Anaesthesiology, Madras Medical College, Madras

THE purpose of postgraduate training in any speciality is to create a specialist in that speciality who requires competence not only to handle a patient suffering from a disease but also to function as a good teacher for both undergraduate and postgraduate training. With added experience he should be able to undertake research and advise on research problems concerned with his speciality. Obviously a person selected for such a training must be capable of a supreme effort. Assessment of the capability of a candidate for such a purpose has proved to be difficult. Being associated with the selection, training, and examination of the candidates for postgraduate diploma in the last six years, I have made serveral observations. Aptitude for the speciality, dexterity to practice the speciality and intelligence required for the speciality are seldom found together in a candidate. As the subject of anaesthesiology is a very comprehensive one, entailing fairly detailed knowledge of all the basic sciences—physical sciences and medical sciences—the candidate choosing this speciality must be capable of both extensive and intensive work. Adequate knowledge of mathematics and chemistry is a requirement to deal with biochemical problems. A first class candidate selected on the merit of his previous academic career has often proved an inefficient anaesthetist either due to lack of aptitude or skill or want of all-round knowledge. On the other hand, it is common experience to find several good, safe and smart anaesthetists incapable of memorising for an examination and shy of theoretical problems, with or without academic interest. At this point I wish to say that the prevailing common opinion that a doctor does not need knowledge of mathematics is no longer true. A candidate who has done mathematics in his pre-medical period is definitely at an advantage to understand and solve the modern physiological and biochemical problems and also to understand the functioning and set-up of electronic devices. Bearing all these in mind a selection has to depend upon the following criteria.

(A) Aptitude.
(B) Practical skill.
(C) Possession of all-round knowledge.

Then only the question of assessment of these criteria arises.

(A) Aptitude: Aptitude is an individual phenomenon which is developed only when the person is given an opportunity to work for a minimum period in that department. I have always ascertained from every house surgeon who leaves the department after working for some time with me his frank and candid impressions of his speciality. Several have replied

that they could be somewhat more useful than a surgeon on the board of examiners but, there again, there is a problem. It relates to their training in related sciences. I feel that the anaesthetist is in a better position to examine in basic and clinical sciences, as he knows what is expected of an anaesthetist in these fields. It is obviously impossible to have a team of surgeons, physicians, pharmacologists, physiologists, and the like, with anaesthetists to act as examiners. Some universities wish to conduct their examination in two parts—basic disciplines, including general principles, and clinical disciplines. There is nothing against such an assessment, provided one does not take it too far to have a Part I examination in common with other specialities, e.g. those appearing for M.S. (Surgery), M.D. (Medicine) and the like. Some of these examinations are wholly conducted by surgeons or physicians. It is essential that such joint examinations in Part I be reoriented with a bias towards anaesthetists and that requires inclusion of at least one anaesthetist on the board of examiners.

The M.S. examination with anaesthesiology as a special subject is sometimes conducted without an anaesthetist on the examining board either for theory, clinical or oral examination. Nothing could be worse than such a pattern of examination in anaesthesiology.

DURATION AND CONTENT OF THE COURSE

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EDUCATION and training of postgraduates in anaesthesia is not simply a matter of handing down a working knowledge of the theory and practice of anaesthesiology. It is meant to prepare them for the sort of professional life they choose to lead. All professional men are confronted with the dilemma that there is too much to learn and too little time in which to learn.

The speciality of anaesthesiology is advancing very fast, and it is becoming more and more difficult for all the present and future anaesthetists to keep pace with the progress. I should like to mention here that an acute shortage of trained anaesthetists is felt in a majority of the urban hospitals and much more in mofussil towns.

Looking at this basic problem I should like to recommend that the postgraduate training in anaesthesiology should be divided into two categories.

Those who are to become specialists, tutors, consultants and research workers in anaesthesiology and (category 2) those who would choose to work in non-teaching and mofussil hospitals, where most of the anaesthetic work is of routine type, not requiring expert techniques and elaborate equipment.

With this in view, I suggest that for the first category there should be a three-year postgraduate degree course in anaesthesiology.

This should be again divided into two parts of one and two years from the point of view of both theoretical and practical training respectively. The contents of the course in Part I should consist of (a) anatomy, (b) physiology, (c) pharmacology, (d) pathology, (e) physics: all related to anaesthesia.

Broadly speaking, the candidate should have a working knowledge of all the basic sciences, with special stress on the following:

(1) *Anatomy:* (a) respiratory and circulatory system, (b) anatomy in relation to local and regional analgesia.

(2) Physiology: (a) circulatory system, (b) respiratory system, (c) nervous system, (d) endocrines, (e) metabolism, (f) fluid therapy and electrolyte balance, (g) temperature regulation.

that they do not have the liking for this subject while a few have said that they had not known before that anaesthesia could be so exciting and interesting My own observations about their work also several times confirmed that some of the candidates were not fit for the discipline of anaesthesia. Therefore a departmental examination is necessary to make the candidate finally opt for this subject and his merit is also to be assessed by a senior anaesthetist. It is of course taken for granted that when a person enters a particular department the senior teacher endeavours to make this speciality attractive to the newcomer. If this is not done a candidate is unlikely to form any impression at all. The aptitude for the candidate for that speciality has to be certified by the chief from personal contact. This is possible only when records are maintained in the department about their work, efficiency and conduct. A confidential recommendation of the chief should be obtained before the selection is made (No importance should be attached to routine testimonials submitted by the candidate.)

Intelligence: This should not be judged from the marks obtained in any particular examination. The performance of the candidate during the period of studentship should be studied. At least the performance in pre-medical and undergraduate medical college career should be scrutinised. A candidate who has failed more than twice should be considered below average. Good performance in all subjects is distinctly better than very good marks in one subject. Therefore, in the applications called for, complete information regarding their performance, failures and distinctions should be obtained. Consistently average performance throughout the studies should be preferred.

(B) Skill: I have laid great stress on this factor because a practical subject like anaesthesiology requires skill. The best and probably the most competent person to certify about a candidate's skill is the chief with whom he had worked during the previous training period. This means that no person should straightaway be selected for a postgraduate course unless he or she has worked in that speciality before and a favourable confidential report from the chief of that department obtained. Confidential reports from the heads of the departments should be obtained directly by the selecting authorities.

Having studied the applications of the candidates, is it necessary to interview a candidate?

Psychological behaviour of the candidate during an interview is sure to misguide the selectors. Even outstanding candidates often in the excitement of an interview fail to impress while some bold happy-go-lucky candidates fare better than those superior to them. It is a waste of time and money for the candidate to appear for an interview and a greater waste of time for the selectors to interview so many. If every information is given in the application itself where is the necessity of interviewing a candidate? Besides factors like personal influence are sure to influence the judgement of selectors if personal interview is held.

Another method of assessment is entrance examination, but it is common knowledge that mere examination is no test of any person's capacity, particularly practical skill, aptitude, etc.

Thus, information given by the candidate in his application and the confidential testimonials from his or her previous chief are our only guides and for selection I think these suffice.

But it is better if the candidates are selected provisionally subject to their being found fit for training, and final selection is made after a month's stay with the senior staff.

23. Pediatric anaesthesia.
24. Anaesthetic management in war and explosion casualties.
25. Anaesthesia for emergency surgery.
26. Geriatric anaesthesia.
27. Respiratory and cardiac resuscitation.
28. Hypothermia.
29. Hypotensive anaesthesia.
30. Intravenous anaesthesia.
31. Rectal anaesthesia.
32. Spinal and epidural analgesia.
33. Field blocks and nerve blocks.
34. Blocking of special sensory nerve ganglions.
35. Refrigeration analgesia.
36. Clinical aspects of inhalational agents.
37. Clinical aspects of muscle relaxants.
38. Oxygen therapy.
39. Fluid and electrolyte balance.
40. Blood transfusion.
41. Treatment of acute respiratory insufficiency.
42. Role of anaesthetists in the treatment of poliomyelitis, tetanus, drowning, barbiturate and opium poisoning, etc.
43. Anaesthetic management at high altitude.
44. Sterilisation of anaesthetic equipment.
45. Medicolegal aspects of anaesthesia.
46. Anaesthesia and recovery rooms.
47. Intensive therapy and its management.
48. Post anaesthetic complications (1) immediate (2) delayed.
49. Lectures on medicines and surgery related to anaesthesia, by the respective professors in the subjects.
50. Anaesthetic accidents.
51. Electro-anaesthesia.
52. Hypnotism.
53. Anaesthesia for diagnostic and therapeutic procedures.
54. Hypoxia and hyper-carbia.
55. Shock, causes and treatment.
56. Various types of Mechanical 'Respirators' and their principles.

The above subjects can be covered by lectures, clinical demonstrations in anaesthesia room, seminars, films, televisions, clinicopathological conferences, laboratory experiments and mortality and morbidity discussions.

During this period of three years, ideally, the candidate must do one six months' resident's post, either in medicine or in surgery, and then all along he should hold some responsible post in the department of anaesthesiology for the rest of the period. But looking at the limited number

(4) Pathology: (a) pathology in relation to circulatory, respiratory, metabolic and nervous diseases, (b) post-mortem findings in deaths, related to anaesthesia and poisoning.

(5) Physics: (a) laws and pressures of gas, (b) measurement of gases, flow meters and gauges, (c) evaporation, pressure reducing valves, (d) explosions, combustions, flames and detonations, (e) heat loss during anaesthesia, (f) injector principle, (g) principle of anaesthetic machines, etc.

A candidate will have to spend three half-days in a week for six to eight months in the above departments to learn the topics. This could be done by means of lectures, small group demonstrations and laboratory experiments (especially in physiology, pharmacology and physics).

Along with this the candidate starts his practical training in clinical anaesthesia under experienced guidance for six months in different surgical departments, after which he can be assigned duties of a junior resident anaesthetist. The candidate should be allowed to appear in Part I exam, not before completion of one year of postgraduate studies as detailed above.

(Category One) PART II :

The duration of the training of Part II should be two years. During this period the candidate should have continual practice in anaesthesia under a recognised teacher, availing himself of the opportunities afforded to him of conducting anaesthesia independently. During the latter half of the training the candidate should have opportunities to teach and instruct at an undergraduate level. The contents of the course should be:

1. History of anaesthesia.
2. Theories of general anaesthesia.
3. Signs and stages of general anaesthesia.
4. Pre-anaesthetic evaluation of the patient.
5. Knowledge of E.C.G., E.E.G., X-rays, and routine laboratory investigations.
6. Pulmonary function tests and their assessment.
7. Pre-anaesthetic medication.
8. Various anaesthetic techniques and agents.
9. Postures on the operating table.
10. Interpretation of various monitoring devices during anaesthesia, including electronics.
11. Anaesthesia in dental surgery.
12. Analgesia and anaesthesia in neuro-surgery.
13. Analgesia and anaesthesia in ophthalmic surgery.
14. Analgesia and anaesthesia in E.N.T. surgery.
15. Anaesthesia in abdominal surgery.
16. Analgesia and anaesthesia in the surgery of spinal column.
17. Anaesthesia for the surgery of the lungs and heart.
18. Controlled respiration.
19. Apnoec patient, causes and treatment.
20. Heart-lung machine and cardiac by-pass.
21. Analgesia and anaesthesia for plastic surgery.
22. Analgesia and anaesthesia in obstetrics.

METHODS OF TRAINING IN ANAESTHESIOLOGY

DR. S. K. CHATTERJEE

Professor of Anaesthesiology, Institute of Postgraduate Medical Education & Research, Calcutta

IT has now been accepted by all that anaesthesiology is an equally important branch of medical speciality as any other. It has also been accepted that one must acquire specialised knowledge before one can be considered as a specialist. Possibly there is no other branch of medicine where a correct decision is so vital, as anaesthesiologies for a wrong decision may cause death or permanent damage to the vital parts of the body quickly. The parameter of anaesthesiology has increased tremendously in the last ten years. The anaesthesiologists' field of activity has encroached practically upon the field of every other branch of medicine. It is no longer restricted to the operating room only.

This speciality being one of the most recent ones adequate trained personnel are not available at the moment in our country. In my opinion, it will take many years to adequately fulfil the demands. So, the question arises how to train young men as quickly as possible and at the same time maintain a high standard of work, comparable to that of scientifically advanced countries. We have therefore to solve the following problems:

1. To train as many persons as possible to do the clinical work so that the anaesthetic mortality and morbidity may be the minimum and also to see that the surgical team gets the maximum facility to do the job.

2. To train persons to do anaesthetic work of a higher type and on a more scientific basis. They should be able to help other specialities apart from the anaesthetic work in the operating room.

3. To train persons who will take up the highest type of anaesthetic problems and carry on the research work on any aspect of anaesthesia or its ancillary subjects, and also to train persons to be teachers of the first two groups.

In order to implement the above programme I think there should be mainly three courses of studies in addition to a group (Gr. IV) which I will mention later on.

of well-equipped teaching hospitals in the country and the dearth of house posts in them, all candidates may not be fortunate enough to get these posts in a teaching institution. Therefore such candidates should have six months of postgraduate training in medicine or surgery and, after doing at least a six-month resident anaesthetist's job, they should take up a regular postgraduate course in the remaining period.

While doing this postgraduate course the candidate should have ample opportunities to work independently under the guidance of a senior teacher. His work should be checked and certified by his postgraduate teacher, especially if he is not holding any post. Also a candidate must prepare a thesis or dissertation based on his own statistical or research work, certified by the postgraduate teacher concerned, before he can take up the final examination.

Here I may suggest that some posts in medicine, surgery, and anaesthesiology in semi-charitable hospitals, possessing adequate number of beds, variety and adequate number of operation and anaesthetic equipment may be recognised for this course. For the second category the course should run for one year; this category is chiefly meant to fillup gaps in the anaesthetic service, in rural and mofussil hospitals.

These candidates should have a concise knowledge of basic sciences and basic principles of anaesthesiology. They must learn techniques like open-drop ether, intra-tracheal anaesthesia, Flagg's Technique, local and spinal with their complications and treatment. The use of simple machines like Oxford vaporiser and bellows where gases are not essential should be stressed. Moreover they should have extensive training in resuscitation of all types, such as neonatal asphyxia, barbiturate and opium poisoning, etc. They should learn thoroughly simple methods of artificial respiration, cardiac resuscitation and external cardiac massage, etc. At the end of this, they should take diploma examination.

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As there are so many avenues open for young graduates, we are finding a difficulty in getting enough candidates for the course and consequently some arrangement should be made to create interest amongst them to take up this line. This can only be done if there is allotment of undergraduate students to this branch, say for two months During this period, they should be taught not so much about anaesthesia as the care of unconscious patients and resuscitative measures for those who have had severe shocks. This will benefit them even if they do not take up the discipline of anaesthesia later on in life.

These graduates should have 6 months of special or obstetrical and gynaecological training and 6 months of training in internal medicine departments.

Duration of the Course—One year.

Lectures

(a) There should be arrangement for one weekly meeting on mortality and morbidity cases that occurred in the hospital in the week previous. All students and instructors must attend these meetings.

(b) Lectures on clinical subjects covering all aspects of common surgical operations including pre-and post-operative care. Duration about 50 hours.

Clinical Work

The students should get the opportunity to do anaesthetic work under the personal guidance of the instructors. They will have the opportunity to do all types of common surgical operations. They must see patients pre- and post-operatively and know how the common complications are managed They should also be taught about respiratory deficiencies and treatment of persons in shock. They must also attend emergency cases.

More stress should be put on clinical work. The lectures should be arranged in the afternoon so that the clinical study may not be hampered.

These students should be trained to do the work with simple gadgets and commonly available drugs. They should be trained specially in "open drop ether" and "spinal analgesia" because it will take a long time to have the small hospitals equipped with the necessary instruments.

Examinations

After one year there should be a certificate examination. Successful candidates may be utilised in district or rural areas.

This course of study should continue for the next ten years. By the end of this period it is expected there will be a sufficient number of people of the next group who are better trained to take up their place when this course can be abolished.

GROUP II—DIPLOMA COURSE

Selection of candidates: Should be made from amongst the students of the first group.

Institution for study: Should be postgraduate medical institutions and some approved undergraduate colleges.

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Institution for study: Should be postgraduate medical institutions and some approved undergraduate colleges.

Each student should be put on a particular problem and do research work for 2 years and then submit a thesis. In the meantime, he should do clinical work in a hospital.

Lectures

There should be selected lectures totaling 50 hours both in basic and clinical subjects These lectures should be of a higher type and different from those of the D.A. course.

They should devote enough time in the biochemical, pharmacological and animal experimental laboratories.

Clinical work should be of a higher type and include nerve block, problems of electrolyte balance, intensive care unit work, etc.

Endeavour should be made to secure the services of guest lecturers from foreign and/or adjoining states.

M.D. or M.S. course should include teaching course for D.A. students during the last six months.

Examination

Final examination should be held after the thesis is accepted and there should be written, oral and practical tests in which there should be external examiners as well.

Method of Teaching for Teachers and Instructors

During the first few years, teachers should be recruited for D.A. course from amongst the qualified D A. candidates who will give an undertaking that they will join the M.S. or M.D. course. But the ultimate aim should be to recruit from amongst the M.D. or M.S. anaesthetists.

These would-be teachers should be rotated in different branches of anaesthesia to give all-round training and after some time they should be asked to work in one particular branch in which they would become super-specialists.

GROUP IV—THERE SHOULD BE ANOTHER COURSE—D Sc. OR Ph.D.

This should be limited to teaching staff and they should be encouraged to do original research on any particular aspect of anaesthesia. There should be no time factor or rules regarding guidance.

Part II—More stress should be put on hospital work. Here the students should be deputed on more specialised types of work such as:

1. Thoracic.
2. Neuro Surgical.
3. Nerve Block.
4. Intensive Care Unit.
5. Maternity and Baby Care Unit.

Lectures—Besides weekly morbidity and mortality meetings there should be theoretical lectures covering all aspects of anaesthesia—which would require about 60 hours to complete.

There should be lectures from other specialities, e.g.,

1. E.C.G.
2. E.E.G.
3. Principles and scope of thoracic surgery.
4. Medicine of interest to anaesthetists.
5. Neurology.

Here too I would recommend that anaesthetists should take over in the long run. Otherwise the actual problems from the viewpoint of anaesthetists will never be solved.

The head of the department should endeavour to arrange a few lectures from amongst the anaesthetists of the neighbouring countries or States. This will raise the standard of teaching and also the uniformity of the standard itself among neighbouring institutions.

At the end of the course there should be an examination and there must be external examiners so that the standard may be maintained.

RESEARCH PROGRAMME

Students of this group should be trained with the purpose of making them absolutely reliable in clinical work. As a rule, research work should not be included in this course. If a candidate wants to do any research work he may have the opportunity but that only after he completes his clinical work thoroughly.

Examination over, these students should work in district hospitals for at least 3 months where the facility of work and equipment are not up to the mark. They should however try to improvise in these altered situations. The diploma should be conferred after they finish the practical work.

Examination: At the end of the course there should be an examination and successful candidates should be given diplomas.

GROUP III—M.A. OR M.S. COURSE

Selection of Candidates

(1) From amongst the qualified D.A. students.

(2) Certified students who have worked in a well-recognised hospital continuously for four years.

sounding dogmatic, I should like to suggest that this is a subject which can essentially be learnt only in a three-dimensional manner, whether it be in the form of cadaver dissection or stereoscopic atlases. Every postgraduate student should get an opportunity to perform dissection in the cadaver especially involving those regions which are of particular interest to the anaesthetist. This should require devotion of several hours to dissection of thorax, head and neck, vertebral column and upper limb, etc. Surface anatomy and landmarks for nerve blocks also must be given sufficient emphasis. I feel that there is little need for didactic lectures in anatomy and this may be dispensed with altogether. If, however, a course of lectures is undertaken it must be relegated to undertaking of the exposition of the anatomically "less obvious" regions like different components of the central nervous system, etc. Considerable time should be devoted to demonstrations of specimens and dissecting room work. It is of course unnecessary to say that attention must be pre-eminently focussed on the regions that are of special interest to the anaesthetist, larynx, vertebral column and so forth. It would be desirable to utilise this opportunity to demonstrate the different anatomical situations and approaches for nerve blocks as well, even though it would be best to learn these from the living body. I would suggest that in addition the students must be made to draw simple anatomical diagrams, based on their experience with specimens and dissection.

Anaesthesiology is essentially a reversible trespass, call it physiological or pathological, as you like. Physiology is thus without doubt one of the most important subjects, but applied physiology is of greater import than "pure" physiology. This subject would benefit considerably from theoretical lectures and discussions. Among the important aspects of physiology from the anaesthetists's point of view are the control of respiration and circulation, cardiopulmonary function in some detail, circulation in various organs like kidney, liver, brain, metabolism, neurohumoral transmission, consciousness and its neuronal pathways, hormonal influences and endocrine organs, nervous mechanism of sensation, pathways of pain, autonomic nervous system circulatory adaptations to posture, effects of IPPR, asphyxia, neonatal physiology and physiological alterations in pregnancy, etc. Added emphasis must be placed on cardiopulmonary function and its assessment. Various vital organ functions and tests must receive due consideration.

Being allied to physiology, biochemistry will be mentioned here. This subject is more "in the news" these days. Specially important from the research point of view, it deserves better attention than it usually receives. A refresher course of biochemistry taught to the undergraduate must suffice. The chemistry of respiration, metabolic pathways, effect of heat and cold on tissues, acid-base balance, biochemical alterations in diseases like diabetes, acidosis and alkalosis of metabolic or respiratory origin, biochemistry of blood and blood transfusions, isotopes and their applications, etc., all must receive adequate consideration. A brief survey of the fundamentals of organic chemistry is also helpful. A simple but well-equipped experimental laboratory attached to the department of anaesthesia is a useful addition. Biochemical demonstrations are important and analytical methods like arterial gas measurements, pH, bicarbonate, etc. must be taught. It seems reasonable to teach the fundamentals of acid-base chemistry in a series of lectures.

TEACHING OF PATHOLOGY AND BASIC SCIENCES IN THE CURRICULUM OF ANAESTHESIOLOGY

DR. PRITAM SINGH

Amritsar

IT is difficult to overemphasise the need for a proper foundation of basic sciences in the teaching of anaesthesiology. However this statement needs emphasis for several reasons. They are as follows (i) Even though acknowledged as a sound concept, knowledge of basic sciences is rarely applied with zeal in the instruction of anaesthesia in our country where instruction remains "clinical" for the major part; (ii) prevalence of uneven stress or emphasis on one subject among these basic sciences, often to the detriment of the others, ending in an unbalanced growth; (iii) the fact that many of the recent contributions to anaesthesiology and its development are dependent upon these subjects; (iv) the present amorphous position of teaching of these subjects with little demarcation or boundaries.

To enumerate these basic sciences: anatomy, physiology, pharmacology form the major trio; while pathology, biochemistry, and physics lag behind to form a lesser three. Some knowledge of biometrics, statistical applications and medicolegal aspects of medical sciences is also an asset The relative impottance that should be attached to these subjects and the methodology of instruction as far as the curriculum of anaesthesia is concerned are topics that should engage our concern.

It is superfluous to say that all instruction must be undertaken by competent hands preferably by senior members of the staff. However, it appears that better participation could be achieved if the students themselves are entrusted with some of this work Here discretion must be exercised since the students cannot be expected to do as well as the senior staff. It is desirable for the growing anaesthetists to undergo a brief period of rotation in the various non-clinical departments like anatomy, physiology, pathology and biochemistry. This will also remove the prevailing misconception existing in the minds of the staff regarding the requirements of the anaesthetists. Questions and discussions must necessarily form an integral part of the lectures and may take the form of seminars and symposia on the basic subjects. Only close co-operation of the staff of anaesthesia with that of various basic sciences will achieve good results. Even though the instruction is given in basic sciences it must be of the applied variety in order to preserve the compactness of the subject of anaesthesia. Also some efforts must be made to achieve a final integration among these subjects, to converge to a final common path, so that coherence may be preserved.

To consider these subjects one by one, anatomy seems to be suffering from considerable neglect in these days perhaps due to the decline in the use of regional anaesthetic techniques. However, I feel that for years to come, in our country, regional techniques like subarachnoid block and brachial plexus block, etc. will have considerable utility value. At the risk of

Pharmacology on the other hand usually gets the attention it deserves perhaps due to the intense aud constant preoccupation of the anaesthetist with various drugs. One wonders whether it will not be after all better to teach this subject under the guidance of an anaesthetist himself with close co-operation of the pharmacology staff for experimental work. The mechanism of drug uptake, distribution and elimination should receive emphasis. Among the topics of interest to the anaesthetists are narcotics, sedatives, hypnotics, anaesthetic drugs, tranquillizers, skeletal muscle relaxants, vasopressors, local anaesthetics, drugs antagonists and analeptics, steroids, cardiac glycosides, ganglion-blocking agents, catechol-amines, drug therapy of certain diseases like diabetes, hypertension, hyperthyroidism, etc. Special emphasis must be placed upon the assessment and screening of various types of drugs, toxicity studies, etc. It is widely acknowledged that the anaesthetist has a unique opportunity to study experimental pharmacology in human subjects in the diseased state or otherwise. However, one is apt to be disappointed at the opportunities that are not availed of. Rich treasures await the eager mind with a leaning towards research. Various drugs can be tested for their efficacy in these days when manufacturers claim every drug to be a panacea for anything and everything.

Pathology is conspicuous as one of the subjects which have been neglected among the important basic subjects. The patho-physiology of various disease states as well as toxicology may form the essential framework here. The anaesthetists's interest in a variety of topics like effects of high altitude, hypoxia—acute and chronic—water and electrolyte imbalance, diabetes, pathology of aspiration of gastric contents, pulmonary diseases, cyanosis, haematological changes after anaesthesia, shock, effects of various drugs on the liver, eclampsia, etc. provides a fertile field for exploration and correct understanding of the subject. Specimen and slide demonstrations and didactic lectures must be combined. Attendance at post-mortems would be useful especially in all cases of anaesthetic deaths. Incidentally, forensic medicine comes to the attention of the anaesthetist in the guise of "law in anaesthesia" and must be carefully discussed as its importance has tremendously increased in everyday life. It is common to find that many anaesthetists have little understanding of responsibility in the legal sense, and the law as it pertains to the anaesthetist especially topics like malpractice and responsibility, keeping of anaesthetic records, and safety factors and defence in the case of an accident must be explained in all detail. One may argue that the subject of law is more closely interwoven with clinical anaesthesia but I would like to regard it as one of the basic requirements in anaesthetic curriculum since it stands aloof by itself from other subjects. This is more so since there is developing concern with medicolegal complications in our country these days.

Physics needs extra emphasis. This important subject is difficult to instruct without the help of a physicist. The gas laws and their applications, various types of anaesthetic apparatuses, measuring devices, explosion hazards, osmosis, diffusion, mechanical respirators, vaporisers, simple electrical circuits and fundamentals of medical electronics must be included. The ideal plan would be to have the service of anaesthesia department. I am sure his presence will be invaluable. I shall not refer to the innumerable applications of physics to the science of anaesthesia. Suffice is to say that the speciality is on the verge of becoming even incomprehensible in these days of mathematical models and electrical analogues. One of the important

jobs is a basic instruction on the physics of the anaesthetic apparatuses and other gadgets. Professor Tandon of Delhi is the only lucky one to my knowledge to be such a specialist.

In these days of profuse publications, assessment of what is being written or read becomes increasingly difficult due to an imperfect understanding of statistical modes of approach and the applications of biometrics. It seems wise to take counsel from an expert statistician when one is about to design an experiment as for example in research. This is very important and many hospitals are now lucky to have statisticians but I feel their services are not being utilised adequately. The study of populations, sampling, data collection, probability, variables, analysis and graphical representation of data are also to be taught. The necessity of a good record-keeping arrangement is obvious.

There must be, in addition, a reliable departmental library for the sake of reference. These days most of the shelves are stacked with books on clinical anaesthesia and little room is given to books on basic subjects.

What emerges ultimately? What are the results aimed at? What can be reasonably achieved by a close co-operation between the staff of the departments of anaesthesiology and the various basic subjects? How far have we fallen short? What are the possible avenues along which progress may be achieved? These are difficult to answer in a generalised manner. Everything here depends upon time, place and the exact needs. I have tried to present only a general picture Of course the precise emphasis will depend upon the type of instructions given in anaesthesia, whether a department wants to produce "clinical anaesthetists" out of the trainees—a growing need ever requiring replenishment—or whether teaching is essentially related and aligned to courses granting degree or diploma in the subject. In the face of an acute dearth of good anaesthetists all over the country, to provide sound basic instruction in these subjects seems to be the first and most important step.

In the end, I should like to re-emphasise the lack of close co-operation between the anaesthesiology staff and that of basic subjects In our own Medical College at Amritsar, we are unusually lucky to have a very close co operation between the staff and students of anaesthesiology and the staff of the various non-clinical basic sciences. There is the necessity for some uniformity in various centres in the country and also the need to remember that the growth of anaesthesiology as a specialty may well be a question of proper emphasis on these basic subjects.

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draw out the details of the particular project on which they would be working for their thesis. And occasionally a few amongst the postgraduates may come to accept the challenge of yet unexplored avenues and may evolve as real researchers. Adoption of thesis as requirement for postgraduate degrees would also be useful for the teaching departments of anaesthesia in that it would keep the spirit of research alive and would prevent "fossilization."

The argument that indulgence in research activities by the postgraduates results in waste of time without any real advancement of knowledge has not much force. The reason why postgraduate research projects do not bear much fruit is not because they are undertaken by postgraduates but because the teachers who are responsible for planning and guiding them do not evince much interest in the projects either because of heavy administrative preoccupations or because of too large a number of postgraduates being admitted.

Another argument may be advanced against adoption of thesis based on research as requirement for postgraduation. It is said that the country's requirements for specialists in various branches of medicine including anaesthesiology are great and training programmes should be planned to produce the largest number of specialists in the shortest possible time. There is no denial of this vast requirement. To serve this purpose the diploma course in anaesthesiology is best suited. This should include intensive practical training in anaesthesia along with didactic lectures on the theoretical aspects. But to my mind even for this course some sort of training in evaluation of research may be useful and that could be provided by requiring the diploma student to write a dissertation on a topic which may be related to everyday practical work in the speciality of anaesthesiology.

But along with the need for a large number of practitioner specialists in anaesthesia, to staff the various hospitals, one should not forget the equally important need for teachers in the speciality of anaesthesia to fulfil the man-power needs of teaching departments of anaesthesiology in the large number of medical colleges in the country. And, as a postgraduate degree like M.D. (Anaesthesiology) would be the basic qualification for the teaching appointment, the programme for the training course for M.D. (Anaesthesiology) will have to include training in the methodology of research. As has been already explained, adoption of thesis as requirement for M.D. (Anaesthesiology) would serve this purpose admirably.

A few words about the practical details of organising the research work for thesis in the departments of anaesthesiology would not be out of place here. First of all the number of postgraduates in M.D. Anaesthesiology should be limited according to the facilities available, both material and human. The candidate must devote at least one year to the research work for preparing his thesis. This minimum period of one year is recommended because quite a few weeks may be needed to prepare the plans and set up the techniques for carrying out an investigation. If there is some comprehensive research scheme in progress in the department of anaesthesiology certain aspects of that scheme may be entrusted to the postgraduates for their thesis work. The projects should be well planned in advance. The help of colleagues in other specialities and the statistician may also be sought in planning these projects. When organised on these lines, the project would definitely prove useful, both for the training of the candidate and for advancement of knowledge in the speciality of anaesthesia.

THESIS OR DISSERTATION AS REQUIREMENT

Dr. R. P. Badola

Professor of Anaesthesiology, K. G. Medical College, Lucknow

IT will be advantageous to define, at the very outset of this discussion, the nature of the subject matter which may form the contents of a thesis or dissertation, as there appears to be some difference of opinion on this matter. It has been assumed here that a thesis incorporates a candidate's own research work along with a review of the existing knowledge on the subject while a dissertation is just a treatise or discourse on a subject compiled by collecting as much information and knowledge on the subject as is possible from a perusal of published works on that subject. The question whether we must adopt a thesis or a dissertation as requirement for postgraduate examinations has been considered with these basic presumptions regarding the nature of their contents.

In order to decide which of these two should be a requirement for postgraduate training in anaesthesiology, the aims of postgraduate examination in this speciality should be defined. These aims may be twofold. Acquisition of technical proficiency in order to be able to undertake advanced practical work is one of the important aims of postgraduate specialisation. But technical proficiency should not be the only hall-mark of a specialist Postgraduate education should also lay an equal emphasis on preparing a candidate to be a successful teacher in university departments.

As a matter of fact a specialist of any sort must have a wide and sound knowledge of his field as a whole with a width of vision essential to a balanced and critical outlook. Even if he is not interested in conducting research on his own he should be able to understand and critically evaluate research in his speciality. For a specialist who aspires to or happens to hold a teaching appointment, the ability to conduct and guide research must be one of the essential requirements.

Postgraduate training programmes must, therefore, include some sort of a training in the methodology of research. Didactic lectures alone can never be sufficient Methodology of research can best be learnt by undertaking some research activity on one's own.

Informal research may be of value as a method of education. Research encourages original thinking, it develops the habit of enquiry and keen observation, it inculcates the ability of proper deductive reasoning and engenders intellectual self-reliance. Research activities in a university department not only provide opportunities for the beginning of a productive research career for postgraduates but also help in improving the quality and standard of undergraduate teaching

And, therefore, it seems desirable to adopt thesis as a requirement for a postgraduate degree course. Although research by postgraduates may not be expected to contribute much to the advancement of knowledge, it would at least serve to provide a period of apprenticeship in independent learning. It will also familiarise the postgraduates to unsolved problems when they

3. Temperamental and educational fitness.
4. Maturity as a doctor.

I cannot be expected to improve upon what he has suggested. These must be our ideas to cherish, practice and achieve.

The problem, before this gathering, thus, is not to improve on these, but to discuss ways and means by which one can reasonably and precisely imbibe these qualities in those who are going to be future anaesthetists.

The Examination, both written and *viva voce*, is a time-honoured method by which one judges the suitability of candidates. In spite of its being a time-honoured method, I doubt if it could be considered a fool-proof method. The variables are too many and we cannot make it a standard method. Everytime I have attended the meeting of Examination Boards the famous saying by Colton—"Examinations are most formidable to the best prepared, for the greatest fool can ask, more than the wisest can answer."—came to my mind.

The nervousness of candidates, although quite common, varies with individuals and often it is a great hindrance A shrewd examiner can spot this and sometimes make the candidate be at ease, but this is not enough Three years of study is to be assessed in, say, three hours, which perhaps is to be practised, taught and disseminated for thirty years. Does it not seem odd?

Every examiner has some strong likes and dislikes and it is possible for a pupil to know these in which case he generally comes out in flying colours Often anxiety and illness prevent a candidate from taking an examination. And even if he appears, can he compete with his partner who is sound in health?

I must say that this is true for all the disciplines and not particular only to anaesthesiology. Perhaps teachers in other branches can lay their heads together to evolve a method which is devoid of the drawbacks of examinations

I recall, as school students, we had a system of *surprise* tests every Saturday, and only those who were up to date in their reading could come out successfully. I am convinced that this method of assessment has greater practical value and applicability than our conventional terminal or annual examinations.

Anaesthesiology is in truth a highly practical science, and success as an anaesthesiologist must in the final analysis mean that his patient suffers the least psychologically in the pre-operative period and leaves the O.T. unscathed.

All this does not depend on the technician. It requires a physian's turn of mind, with a thorough training in basic sciences, and an up-to-date knowledge of modern medicine. It aims at assessment and appraisal both of oneself and of the surgeons and in the final analysis at bestowing on the patient the highest care. In the examination halls or even in the *viva voce*, how could these elements be known?

METHODS OF ASSESSMENT

DR. V. B. BHARGAV

Bombay

BEFORE one considers the "Methods of Assessment," what does the word assessment signify? It must mean, both in implication and significance, success or failure, good or bad. If one spells out what constitutes success, one needs to spell out the qualities of success or the qualities of a successful anaesthetist.

1. Acquisition of technical skill.
2. Understanding of physiological and pharmacological processes, involved in the administration of anaesthetics.
3. Temperamental and educational fitness.
4. Maturity as a doctor.

The problem, therefore, is to discuss ways and means by which one can help the future anaesthetists to acquire them.

Examination, both written and viva voce, is a logical thing to consider under "Methods of Assessment," after having discussed the methods of selection, methods of training, etc. It is obvious that even when methods of choosing and training are ideal or perfect, there must be some norm which can help us to say if our final choice is correct or not. The fact that a judgement is to be passed is indeed a deterrent to the complicity and slipshod attitudes that may permeate even an ideal set-up. It can however be argued that if the methods of choosing and aptitude tests are correct it follows as a corollary that the final results by and large must be satisfactory and methods of assessment in such an ideal set-up may become superfluous. Perhaps it will be appropriate to discuss this point which may not have a universality of acceptance. Anyhow for the purpose of our present discussion let us consider the "Methods of Assessment" as acceptable.

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These qualities have been very well elaborated by Prof. Mushin in his 1st Guedel Memorial Oration in Los Angeles in 1957. He has indeed precisely and in clear terms indicated what one looks for in an ideal anaesthetist. It is refreshing to state these in brief. These qualities are :

1. Acquisition of technical skill.
2. Understanding of physiological and pharmacological processes, involved in the administration of anaesthetics.

same to situations where one must be distinguished from the other. Inequalities of age groups pose problems. The older men in spite of experience have lagged behind in progressive knowledge, often because of intellectual laziness which starts soon after attainment of degrees, often as a result of inadequate facilities of libraries, or as a result of very little time at their disposal. I know of instances where interview boards are in a quandary, when older, mature and experienced individuals are pitted against a young student fresh from the portals of a University, devoid of requisite experience, none the less steeped in advanced theories of our progressive science. Who is the better of the two candidates? Perhaps it *is a question of experience versus knowledge, of actuality versus potentiality. How best to* solve his problem? While we are discussing this problem should we not work out a reasonably acceptable method of assessment for these situations also?

It has been suggested that executives in reputed firms are often selected after at least a week's stay with the directors of the company. During this week the future incumbents are observed very carefully. I have heard it said that one who studies first in the university is not necessarily the first when it comes to an overall picture. In fact he is often not chosen at all. Is this feasible if applied to our speciality for posts in hospitals?

In a fast changing world, concepts in science change equally fast and what was good only a decade ago is not good enough today. The anaesthetists of yesterday are often considered fossils and old-fashioned. In spite of this the fundamentals enunciated by pioneers like John Snow and Clover are sound and good for all ages. Pharmacokinetics in anaesthesia as understood today, physics related to anaesthesia as understood today, is very *elaborate, but worthy of imbibing for a fuller knowledge. In this context achievements of the* past fade into nothingness and so do the assessments of the past. Expectations and the future vary with advancing knowledge.

In passing judgement, are we to elicit knowledge of fundamentals alone or are the finer details equally important? Perhaps this constitutes a major problem in assessment at different levels.

I am aware that I have talked at great length on the aspects of methods, but have failed to arrive at a really sound conclusion I must confess, even after years of teaching, I can neither see nor think of a method or methods which I feel would be adequate. This is perhaps the first time a group of educators have considered it fit to at least discuss them. *I feel it is* time we had also representatives of students among us for discussion.

The practice of anaesthesia is a century and a quarter old, while the science of anaesthesia is not. The history of this evolution and transformation is a history of trials and errors, success *and failures, and the final achievements of today, collosal as they seem, are still inadequate.* Thus the yardstick of measurement will vary from year to year and so will the methods of assessment.

There can be no static rigidity, and only with the flexibility of approach can we hope to justly discuss methods of assessment.

consuming, prolonged, laborious and fraught with danger in the event of suprarenal over-activity (I mean fright) of the candidate. I would say that nothing is laborious or prolonged when it comes to passing judgement on those who are to be let loose upon the public and unlike other disciplines it is always a matter of life or death conducting anaesthesias, be it ror major surgery or minor surgery. Surely there is no minor anaesthesia. Suppressing the protective reflexes of the patient must mean danger.

One of the accepted modes of assessment is to find out the candidate's ability to express himself and explain and teach others. This too is adequately covered in the M.D. examination at the Institute. A candidate is asked to speak on a subject. He is given 10 to 15 minutes to organise thoughts and then he is asked to speak to a group for about 10 minutes. Perhaps at lower levels of education in our speciality this may be redundant, but indeed in an examinat'on of a higher calibre like M.D. this new system does help us to know that a student can express himself and can use scientific terminology and has a grasp of the subject. Prof. Mushin in discussing medico-legal aspects over a decade ago has rightly stated that a specialist, besides being up to date in the knowledge of his own subject, should also be reading at least two journals outside his speciality, of a general nature like B.M.J. or Lancet.

In my opinion, in the final analysis these two methods, namely, conducting of a case and extempore speech, are improvements upon the conventional methods but they too are inadequate.

The American system of credits on the basis of day-to-day performance is a good supplement. This indeed must mean a more didactic approach, this must mean more day-to-day seminars, this must mean more day-to-day scope for expression, more day-to-day laboratory and biochemical and physical assessment of patients and their interpretations. This day-to-day credit system might demand from the teachers an "art of detachment" which would enable the teacher to have the moral strength to discard the indifferent, the lazy, and the careless pupil as both unsuitable and unworthy, indeed, a failure. In this way we can eliminate those who cram up textbooks at the last minute, and brush up journals.

In this way a teacher can study the personality of the pupil as well. It has been rightly suggested that the "pugnacious and the quarrelsome" personality has no place in anaesthesia. Weeding out such undesirable elements is again a painful but a necessary duty of the teacher. Equanimity of thought and action must be at least an important facet in the method of assessment.

While discussing methods of assessment, we must also think of the teaching methods of the great universities of Oxford and Cambridge, their tutorial guidance and use of library, etc.

Methods of assessment must be different in different contexts. There are often situations demanding different requirements. An anaesthetist, say, in a rural hospital, is required to have qualities which are a little different from those required in a teaching institution· whereas technical competence might satisfy the needs of a rural hospital, superior knowledge, ability to impart it, expression and wider application of knowledge is what is required in a temple of higher learning.

Interviews for selection of suitable candidates for various hospitals also in a broad sense come under this purview. If one can evolve methods of assessment, one can also apply the

same to situations where one must be distinguished from the other. Inequalities of age groups pose problems. The older men in spite of experience have lagged behind in progressive knowledge, often because of intellectual laziness which starts soon after attainment of degrees, often as a result of inadequate facilities of libraries, or as a result of very little time at their disposal. I know of instances where interview boards are in a quandary, when older, mature and experienced individuals are pitted against a young student fresh from the portals of a University, devoid of requisite experience, none the less steeped in advanced theories of our progressive science. Who is the better of the two candidates? Perhaps it is a question of experience versus knowledge, of actuality versus potentiality. How best to solve his problem? While we are discussing this problem should we not work out a reasonably acceptable method of assessment for these situations also?

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REPORT OF THE SUB-COMMITTEE ON ANAESTHESIOLOGY

PROF. G. C. TANDON

Chairman and Head of the Department of Anaesthesiology, All-India Institute of Medical Sciences, New Delhi

GEORGE P. VARKEY

Rapporteur and Head of the Department of Anaesthesiology, Christian Medical College, Vellore

SELECTION

IT is generally accepted that for anaesthesiology we need two types of training: (1) a 12-month course with emphasis on practical training, leading to the diploma in anaesthesiology (D.A.); and (2) a more exhaustive 2- to 3-year training period emphasising academic work, exposure to methods of research and teaching, and advanced anaesthesiology, leading to the degree of M.D. (Anaesthesia). The criteria and methods of selection for these two categories therefore must vary as the role of specialities differs. The suggested criteria for selection are as follows:

1. Candidates for diploma in anaesthesiology should:

(*a*) possess a medical degree (M.B.B.S.) from a recognised university;

(*b*) have completed a one-year post-internship house job, or had not less than one year's practical experience in administration of anesthetics in a hospital with at least 50 beds for surgical patients or surgical specialities, or have accreditation as a specialist in the armed forces.

2. Candidates for M.D. should:

(*a*) possess a medical degree from a recognised university;

(*b*) have a good academic record, preferably not more than two failures;

(*c*) have completed one year of house-surgency, including at least six months of medicine or surgery or anaesthesiology;

(*d*) have either a diploma in anaesthesiology or at least six months' training in anaesthesiology in a recognised hospital;

(*e*) have good confidential reports from previous chiefs;

(*f*) have done well in the interview which should last at least three days so that the Chief can assess the candidate's personality, aptitude, and skill.

DURATION OF COURSE

For the diploma in anaesthesiology a one-year in-service programme where the candidate will be exposed to all methods of practical anaesthesiology is recommended.

For the M D. (Anaes.) a two-year in-service training programme in a teaching hospital

whether the candidate has D.A. or many years of previous experience is considered essential. The traioing should include basic sciences aod clinical sciences as relevant to anaesthesiology.

CONTENT AND METHDDS OF TRAINING

Candidates for either the diploma or the degree should be trained in hospitals, and the number of candidates should he in proportion to the amount of clinical material and the number of teachers available. Lectures hy teachers from other institutioos may be valuable. Basic science and clinical departments should collaborate in the training.

Training for the diploma in anaesthesiology should include pre- and post-operative charting of cases and completely documenting records of ten problem cases. Candidates should have some experience in bronchoscopy and other procedures useful in anaesthesiology, and some training should be given in the therapeutic aspects of anaesthesiology such as treatment of respiratory insufficiency, tetanus, and pain. If possible, candidates should work in district hospitals during part of their course.

Guided individual study should he the hall-mark of traioing for the M.D. (Anaes); therefore the tutorial type of teaching is recommended. Candidates should have traioing in practical methods of anaesthesia and experience in the problems of the recovery room, intensive therapy aod treatmeot of pain. They should participate in all the teaching programmes of the departmeot and should attend poor risk cooferences cardio-thoracic confereoces, clinico-pathological cooferences aod journal club sessioos. Caodidates should be encouraged to publish papers during the course of their training. Examioatioos should be given from time to time.

Study of the basic scieoces should definitely be included in the curriculum. It is recommended that a common teaching programme in the basic sciences, lasting two to three mooths, be established for all postgraduate studeots. Methods of teaching should ioclude use of laboratories, specimens, slides, etc. The course should include fundamentals of statistics. Anatomy, physiology, hio-chemistry, pharmacology and physics are more important io the training of anaesthesiologists than pathology or microhiology.

M.D. (Anaes) candidates should submit a thesis three months before examination, and not he allowed to appear in the examination unless the thesis is accepted. The purpose of the thesis is to initiate the candidate into the methodology and principles of research. The topic should be selected in consultation with the clinical and para-clinical staffs, and the work should be done concurrently with the clinical training. The thesis should be judged on its plan, design and methodology, and oo the evaluation and statistical presentation of results in the light of available literature.

A Ph.D. course in anaesthesiology may be instituted at selected centres. This should be a research degree and regulations for its training, work and assessment should be in line with Ph.D. in other clinical sciences.

this Council and their careers and other working records scrutinised, and the candidates are also interviewed. We have found this system very useful, and similar councils should be instituted in every institution, to weed out unsuitable candidates. The composition of the body can be adjusted according to the local conditions.

REQUIREMENTS OF POSTGRADUATE STUDENTS

There are certain requirements from the point of view of the postgraduate students which must be fulfilled. The present trend is that after completing the house job the candidate works for three years for the degree course. I feel that during this period he must get a reasonable stipend and residental accommodation, so that good students, whose financial condition may not be very good, may be able to stay on for postgraduate study. In lieu of this payment they may be appointed junior members of the medical team of the department, so that they really get the practical experience which is very essential in all clinical subjects In most of the departments of radiology, I see very few junior posts, such as those of residents and registrars and so on. These posts should be increased in numbers, and they should be permitted to join the postgraduate course concurrently. The posts should be treated as scholarships for good students, and these jobs will ensure the flow, and turn-out, of well-trained specialists. It has been my experience that after completing the house job many good students leave to take up paid jobs in various hospitals and jobs like in Provincial Service, Railway Service and so on, and many of the mediocres, or even ordinary students, cannot get jobs and they join the postgraduate course. This brings down the general standard of the course and increases the number of failures.

RESEARCH FACILITIES

In most of the universities, a thesis has to be written by the candidate before he can appear for the examination of M.D. or M.S. For this proper laboratory and other facilities should be assured. A well-equipped library with the latest books and journals is essential. He should work under direct supervision of the guiding staff member and no staff member should guide more than the number that he can really guide and devote his time to. A reasonable number would be four candidates.

In conclusion I would say that in the selection of candidates more stress should be laid on the quality of the candidate, for which there should be some method of assessment. As far as possible there should be enough junior paid assignments available in the department for the postgraduates so that good students may be encouraged to join the courses which are gradually becoming longer in years.

DURATION AND CONTENTS OF COURSE

DR. N. B. ROY

A. *SCHEME OF TRAINING*

AT the postgraduate level, the quality of training imparted should be of the highest order. The first requirement is the separation of radio-diagnosis from radiotherapy for purposes of training and practice. Each branch of radiology has made such a phenomenal progress during recent years that it is no longer possible for one and the same man to practise both branches of radiology with equal efficiency. That is why it has been considered essential in the United Kingdom, Sweden and many other countries to split up radiology into two major divisions. In the words of Gosta Forsell of Sweden, who is considered the father of modern radiology, a man who can practise both branches of radiology with equal efficiency must be a genius and, even for a genius, the time necessary for the regulation of a large department of radiology comprising two widely different activities is a waste of medical talent. This skill might be utilised more advantageously in the examination and treatment of patients. This will only increase his experience thereby making him a better radiotherapist or a better radio-diagnostician. The postgraduate trainee, therefore, should at the very onset select one branch of radiology and quality training should be imparted to him. The country, however, needs more radio-diagnosticians than radiotherapists as the pattern of diagnostic radiology is one of decentrilisation, the service extending even to the villages In imparting the training, therefore, due consideration should be given to the relative proportion of trainees to each branch. As necessarily the practice of radiology will also be completely separate in the future set-up of the country, I would insist that the quality of training imparted should be of the highest order,

I would recommend.

1. One year's postgraduate experience, including at least six months' training as house physician or house surgeon in the general medical and/or surgical wards of a recognised hospital.
2. Any one who fulfils the above qualifications will be admitted to a two-year diploma course either in radio-diagnosis or in radiotherapy. When the students have obtained either D.M.R.D. or D.M.R.T. they can be private practitioners if they so desire or they can accept service. After a couple of years' further experience and working as a registrar in a teaching institution under supervision, these boys can appear for a higher examination such as M.D.—either in radio-diagnosis or in radiotherapy.

After obtaining M.D they can be eligible for higher appointments in teaching institutions.

I must admit that a considerable divergence of opinion exists on the various aspects of postgraduate training in radiology and particularly regarding:

this Council and their careers and other working records scrutinised, and the candidates are also interviewed. We have found this system very useful, and similar councils should be instituted in every institution, to weed out unsuitable candidates. The composition of the body can be adjusted according to the local conditions.

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large number of peripheral clinics serving as cancer detection centres, and covering, in a planned fashion, all the districts and sub-divisions of the State. A larger number of centres can hardly be well equipped and well staffed in view of the heavy financial demands, and, therefore, such institutes can only offer hazardous and unscientific treatments which harm the public. Particularly for India with limited financial resources this is a very vital consideration and I hope that on account of our enthusiasm for quality ability should not suffer.

B. DURATION OF TRAINING

According to the scheme of postgraduate training in radiology, described in Section A, we shall have four different courses and they are D.M.R.D., D.M.R.T., M.D. (Radio-diagnosis) and M.D. (Radiotherapy).

The duration of training of each course is again a highly controversial subject but I would personally recommend a two-year course for both D.M.R.D. or D.M.R.T. and another two-year course for M.D. in diagnosis or in therapy.

C. CONTENTS OF COURSE

1. D.M.R.D.

Part I. First six months.

(*a*) Physics and electro-technics as applied to medical radio-diagnosis including apparatus construction, protections, etc.

(*b*) Anatomy and pathology in relation to radio-diagnosis.

Part II. Next eighteen months.

Radio-diagnosis—film interpretation—lectures, demonstrations and practical experience in the interpretation of the radiographic appearance of normal and of the various pathological conditions which may be demonstrated by X-rays.

Fluoroscopy—demonstration and practical instruction, with particular reference to examination of the gastro-intestinal, respiratory and circulatory systems.

Clinical instruction with special reference to the operative findings and to the final clinical diagnosis of cases investigated in the radiological department.

2. D.M.R.T.

Part I. First six months.

(*a*) Physics and electrotechniques as applied to medical radiotherapy including apparatus construction, dosage measurement, radioactivity, protections, etc.

(*b*) Anatomy and pathology in relation to radiotherapy.

Part II. Next eighteen months.

Radiotherapy—Film interpretation with special reference to the appearances of malignant tumours and the effects produced by irradiation.

Clinical instruction—lectures, demonstrations and practical experience of clinical features, mode of spread and clinical findings of non-malignant conditions and malignant tumours amenable to radiation therapy.

Treatment—systematic and practical instruction in the principles of treatment; treatment of tumours in each individual site; and treatment of non-malignant conditions treated by radiation-therapy.

Statistics and results of treatment—the results obtainable by surgery and radiotherapy and an outline of the principles of statistical investigation with some detail in the simpler methods.

3. M.D. (Radio-diagnosis):

The course should include:

(a) Diagnostic radiology including history of radiology.
(b) Relation of radiology to general medicine, surgery, gynaecology.
(c) Physics and electro-technics as applied to medical radiology.
(d) Pathology, anatomy in relation to radiology.

A candidate is to appear in written, oral, clinical and practical examinations.

4. M.D. (Radiotherapy):

The course should include:

(a) Therapeutic radiology and biological effects of radiations including history of radiology.
(b) Relation of radiology to general medicine, surgery and gynaecology.
(c) Physics and electro-technics as applied to medical radiology.
(d) Pathology and anatomy in relation to radiology.

Written, oral, clinical and practical examinations are to be given.

Research:

It is my feeling that we need not insist on research as an essential requirement while taking M.D. degree either in diagnosis or therapy because it requires enormous time and there is no time to do research in the short period of two years. This M.D. degree can be equated to the level of M.R.C.P. in England where the highest knowledge in clinical subjects is essential but research is not necessary. Those who are interested in research can register their names after taking the M.D. degree in any recognised institution where they can work and carry on research on scientific problems either independently or under a professor and after two years they may submit a thesis to the University in any particular branch or speciality. This will be examined by an appropriate assessment committee and a Ph.D. degree may be awarded. The Ph.D. degree may not be considered essential for any teaching post but certainly it is an additional qualification.

Interim modifications

The problem of postgraduate training in radiology is a highly controversial one and considerable divergence of opinion exists both regarding the institution of diploma and/or master/doctorate courses and the period of training to be allotted to each course and also regarding separation of radio-diagnosis from radiothetherapy both at diploma and M.D. levels. Complete division of radiology into its two major branches of radio-diagnosis and radiotherapy, although ideal, may not be immediately achieved, except at a few advanced

centres, in India as a whole. Perhaps some eight to ten years are likely to elapse before complete bifurcation is achieved throughout India. During the course of this gradual evolution, perhaps a compromise formula may he evolved as an interim measure, to achieve uniformity among the medical educators and administrators throughout the length and hreadth of this vast subcontinent. Some suggestions are given below.

1. A combined diploma in diagnosis and therapy (D.M.R.) of 18 months' duration. This diploma may serve as the window on the higher degree courses. These boys, after completing D.M.R., may serve in districts or as registrars in teaching hospitals.
2. After a couple of years' further training and work under the guidance and supervision of recongnised teachers these boys can appear for an M.D. degree either in diagnosis or in therapy.

Thus for the purpose of uniformity as an interim measure we may have:

(*a*) Diploma—combined.
(*b*) M.D.—after diploma—separately either in diagnosis or in therapy.

Only M.D.'s (radio-diagnosis) or M.D.'s (radiotherapy) should be allowed to hold teaching positions in radiodiagnostic or radiotherapeutic departments in teaching institutions.

METHODS OF TRAINING IN RADIOLOGY

Dr. A.N.K. Menon, M.B.B.S., D.M.R., D.M.R.D. (Lond.), M.S. (Minn.), F.C.C.P. (U.S.A.)

RADIOLOGY is a difficult speciality and in a way may be called a "speciality among specialities." The training in radiology must be based on a very sound foundation of the basic sciences such as anatomy and pathology. Even though comparatively a new entrant in the medical field there is no speciality which has not its counterpart in radio-diagnosis. It is common knowledge that the speciality of radiology is divided into radio-diagnosis and radio-therapy including nuclear medicine. This training in radiology can be further divided into training methods for the basic radiological postgraduate diploma and for acquiring of higher degrees, M.D. or Ph.D.

Training in Radio-Diagnosis: A radio-diagnostician before being trained in the actual radio-diagnosis must have a sound training in radiological physics, radiological anatomy and pathology. The training in radiological physics must be practical. Hence there should be a minimum of didactic lectures. A medical graduate is generally weak in formulae and mathematics and he must not be frightened away by laying over-emphasis on the mathematical physics. After all, a radio-diagnostician is not expected to take part either in the repairs or installation of X-ray apparatuses which are attended to by X-ray engineers and physicists. But as a specialist in charge of the department, often in places where the services of an X-ray engineer are not readily available, he must be well conversant with the working of the different parts of the machines which he and his assistants are supposed to handle. The first six months of the course may be devoted to the teaching of radiological physics; the fundamentals of magnetism and electricity and their practical applications must be very carefully taught. This training will consist of lecture demonstrations for the first half an hour by a physicist or X-ray or electrical engineer on basic principles and it must be followed by practicals which will re-emphasise what he has been taught already during lecture demonstrations. The practical lessons must include the place of fuses, electrical connections in houses and institutions and the elementary defects that may be found in X-ray machines. The trainee should also be given opportunities to do practical experiments on the same. A very good concept of diode and triode valves and their application in electronics which form a large portion of the modern X-ray installations must be given to the trainees. The motors and the generators and their working must be shown to the candidates and they may be asked to handle a motor, that is its operation. As has already been said, the lessons must be simple, not over-loaded with difficult and complicated formulae. These practical lessons must also include assembling of machines. Students must also know about the protection factors in radio-diagnostic departments and they may be able to find an equivalent for a given protective apron. X-ray machines must be installed in the physics laboratories and batches of students must be told of the component parts of the apparatus and also the methods of

be arranged in which radiographs of patients taken when they were living are put on the lobby and the students as well as the teachers are asked to give their diagnosis. As soon as the radiological diagnosis is given, the post-mortem report may be read so that they may know how far their diagnosis is correct. These post-mortem conferences are extremely important for the teaching of radio-diagnosis.

Concurrently with the attendance in this department on basic sciences which often take place in the afternoons, the forenoons should be spent in the recognised X-ray departments for teaching purposes. In this morning session students should be distributed in the various X-ray rooms. Here they should be asked to take radiographs of the various organs and joints under the supervision of an expert technician in radiology. Then they must develop the films in the dark room and thereafter the students should present the films taken and developed by them to the instructor. This should be done for one hour daily in the forenoons The next three hours the students must be asked to spend on the reporting session where the assistant radiologists will initiate them in the principles of diagnostic radiology.

After the Part I examination is over, the next six months or one year must be exclusively kept for training in advanced radio-diagnosis as well as radiological procedures. The lecture demonstrations may be arranged in the afternoons daily by pooling all the available teachers in the training centres. If there are two or three training centres in the university, then the university teachers must meet and distribute the work among themselves in order to avoid overlapping. It is better that each teacher is asked to teach a particular system. Radio-diagnosis is such a vast subject that one cannot be an advanced specialist in all its branches. Each university teacher, side by side with his routine work, must also be asked to make special investigations on a particular branch of radio-diagnosis. With the pooling of all teaching facilities available in radiology in a particular region, the students will get a very good knowledge of the different patterns followed in different branches in different institutions. The didactic lectures must be followed up by projection of X-ray films and X-ray slides. In the future radio-television may play a major and dominant role in teaching radiology. The fluoroscopist while doing specialised diagnosis in his laboratory can have the whole fluoroscope televised at different lecture rooms so that the students can follow what a specialist is actually doing in the fluoroscopic room. By this the students are not exposed to radiation hazards and more in number can sit comfortably in the lecture halls and follow very clearly the television lesson. While the students of each institution go to a particular regional centre for lecture demonstrations, they are expected to attend the reporting sessions in the mornings in their own institutions. Once a week a test regarding film should be given. About a dozen films may be fixed to the various lobbies and the students may be asked to give their readings and write their own diagnosis on a piece of paper. Afterwards they may go to their teacher who will examine the diagnosis. Once a fortnight there should be a seminar and once in two months a symposium. Half of this symposium should be conducted by the teachers, in which the various specialists will participate, while the other half will be performed by the students themselves, wherein the teachers will be present as observers. Besides, each trainee will be allotted one or two journals which he must read and make a summary of

the articles for discussion in the class. Thus the training in radio-diagnosis must be comprehensive, practical, and interesting. Didactic lectures and teaching of theories without practical training which are now outmoded must be given up. According to Late Gosta Forsell of Sweden the radio-diagnostician must have the eyes of a hawk, and we must remember that it requires extensive training and application to have the eyes of a hawk.

Radio-Therapy forms a separate sub-section of its own. It is absolutely essential to have training in radiation physics. A very good practical training in dosimetry must be given and the students must make their own dose measurements on Phantoms. The principles of radio-isotopes must be thoroughly taught. A separate research section for radio-active isotope must be created and this should form an integral part of the radio-therapy department. There should be a scintillation counter in the laboratory and the students must be given practical lessons on scintillation counting A one-week tour for visiting the Atomic Energy establishment at Trombay must be arranged in the middle of the year for showing the students atomic reactors and the production of radio-active isotopes. They must also be shown the working of super-voltage machines. In the pathology part the trainees must have a practical course in tumour pathology and they should be asked to identify the main tumours under microscope. They must attend regularly the cancer and tumour conferences held in the radio-therapy department where the surgeon, the pathologist and the radio-therapist must meet and discuss all the tumour cases and decide the line of treatment. The students must be asked to write case sheets and present them at the conferences. Besides, they must also study the technique and practice of radium implantation and they must also be encouraged to practically do some simple radium implantations. Library work, seminars and symposia may be held on similar lines as in the training of radio-diagnosis.

M.D. (Radiology): There is no limit to the knowledge in this particular speciality in which the candidate wants to take his doctorate degree. Since only those candidates who have taken the diploma courses are taken for the degree course, no training in physics is necessary. These M.D. candidates can be appointed as full-time clinical assistants and must take an active part in the day-to-day working of the department. They must be entrusted with clinical responsibilities. A course of advanced postgraduate lectures may be arranged by the university which may be given to all the M.D. trainees of the region. These lectures may be given in the afternoons so that the training in the institution in which they work is not interfered with. Those working for the M.D. degree should do the major work by themselves; they should receive only directions and guidance from professors. There must be a minimum of spoon-feeding. They must also be given a minimum of training on the clinical aspect of medicine since in some universities there is a *Part I* examination in which they are tested on clinical sciences. They must be conversant with all the advanced, latest publications in the speciality and they must be quite thorough with every film and slide available in the departmental laboratories. They must also be conversant with all the latest journals and must address the whole class once a week on the latest advances made in their speciality. They must also take part in the seminars and symposia held in the speciality in their regional postgraduate centre. They must also work on a special problem

under the guidance of the professor and must submit a dissertation at the end of the course. In short, the training should be given to the M.D. candidate in such a way that a candidate may have a working knowledge of all the latest advances in the subject so that he may be appointed to the post of clinical teacher in the speciality as soon as he obtains the degree.

Those who have taken M.D. can register themselves for the Ph.D. course. In other words the Ph.D. course must lead to a research degree. Consequently a student is expected to spend the maximum of his time in the research laboratories associated with the training centre. A very well-equipped animal house and an animal research laboratory are essential because research is first performed on animals and later on human beings. Research is not a compilation of statistics. There must be some origional contribution to the particular problem on which research is done. After selecting a project for research training the candidates must be told something abont the methodology of research. They must also be given training in statistics and research procedures. Only then should they start working on the problem and they must consult their professor frequently to see that what they are doing is progressing on correct lines. A well-equipped research library and research laboratory as well as an animal house must be made available to the candidates. The research students in the speciality must meet to discuss the problem occasionally so that one benefits from the other. It must be the special responsibility of the supervisor to see that high class research is done by the trainees and theses of good quality and standard are submitted by the candidates.

METHODS OF ASSESSMENT FOR THE POSTGRADUATE DIPLOMA AND DEGREE IN RADIOLOGY

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THE aim of any method of assessment of a student must be to discover whether he has acquired a sound grasp of his subject. It is generally agreed that one final examination is not enough to assess the merit of a student. It is difficult to see how a written, a practical or a clinical, and an oral examination lasting a few hours can adequately test a candidate's proficiency in a speciality of medicine like radiology. Since examinations are conducted by universities, methods of assessment must be uniformly applied to all the candidates of the various constituent colleges of the university. Moreover these methods must be practicable.

The teacher makes a continuous assessment of the student throughout the years by giving periodical tests, by seeing how well a student presents cases at seminars, and by applying other methods But the results of such tests are not taken into consideration in determining the results in the final examinations as they are done in some western universities (Rigler, 1964).

Therefore I should like to suggest that in postgraduate radiology examinations the examiner could form a better idea of the student's ability and his work if the student's record book were made available to him. Such a course is feasible because the number of radiology candidates taking a university examination is small.

The subject of radiology has two main sub-divisions—radiodiagnosis and radiotherapy. In most foreign countries it has been considered appropriate to separate these specialities. This is the trend in India also. This question however will not be considered in this paper. As in other specialities, so also in radiology, there is a diploma examination and a higher degree examination. At the diploma level, it is customary to hold examination in two parts: Part I, Physics, and Part II, Radiodiagnosis and/or Radiotherapy. For the degree there is only one examination. This paper deals with the methods of assessment at each of these stages.

The remaining 25 per cent of the marks may be allotted for the actual performance of one or two experiments at the examination.

No change is suggested in the present system of written examination. Each paper may comprise five or six questions—preferably of the essay type—but one may be a question dealing with the writing of short notes. The examination should last three hours. The emphasis should be on the practical aspects of the subject and on fundamental principles. There should be one question in each paper dealing with current electricity. The remaining questions should be set on radiology physics. At least two of the questions should include a problem. In the paper, Part I for the radiotherapy diploma, at least a part of a question should deal with the physics of radioisotopes.

Part II (Radiodiagnosis) Diploma Examination

A similar method of assessment may be adopted for this part also. The specialist in radiodiagnosis is required to be adept at various techniques which are peculiar to his speciality. He should be able to perform barium meal and anaema examinations, bronchography, intravenous pyelography, urethrocystography, peripheral arteriography, aortography and other investigations. It is not possible during any practical examination to assess the candidate's skill in performing these investigations or else his knowledge of the subject. To obviate this difficulty it is suggested that the candidate keep a record book containing complete reports of cases in which he has assisted or, later, actually performed these special investigations. He may preserve either the full-size X-ray or photographic reductions.

The examination in Part II of the diploma examination usually consists of two written papers each of three hours' duration carrying 100 marks each, a practical examination (100 marks) and an oral examination (50 marks). The assessment of the candidate's record book could form part of the practical examination - 75 per cent of the practical marks being allotted for it. Credit will be given for a complete case report including the history, clinical findings, laboratory and other investigations, the indications for the X-ray examination, X-ray findings, operative findings, histology report and microphotograph, follow-up, and, if applicable, autopsy findings. The remaining 25 per cent of the practical marks may be allotted for the actual performance of one special investigation. In practice this will usually be a barium study.

As far as the written examination for Part II of the diploma in radiodiagnosis is concerned, usually the candidate is required to appear in two papers each lasting three hours. The papers usually contain six essay-type questions but there may be one question on short notes. A suggestion is offered regarding the type of questions to be set. It is not necessary at the diploma stage to question the candidate on the general aspects of the latest or advanced techniques. He would have already described in his record book the use of these techniques And this should be sufficient. The candidate's attention must be concentrated on fundamentals Radiodiagnosis attempts at a visualisation of pathology in the living, hence the quesions in the written paper must be based on pathology. The aim must be to obtain from the candidate a correlation between radiological findings and pathology. Since only knowledge of fundamentals is required, no alternative questions are required to be set.

In the oral examination a carefully selected set of skiagrams may be placed for the candi-

date's interpretation and discussion.

To pass Part II of the examination, a candidate should obtain at least 50 per cent in each written paper and in the oral examination. In addition he should obtain 50 per cent in the practical, including assessment of the record book.

Part II (Radiotherapy) Diploma Examination

The assessment of the candidate in Part II of the radiotherapy diploma is carried out on the same lines. The two written papers should contain six essay-type questions (or there may be one short-note question) and each should carry 100 marks. The questions should test knowledge of fundamentals only and must include the clinical aspects and pathology. There must also be questions on the basic knowledge of the use of radioisotopes in therapy and at least one question may be set on this topic

In clinical examination questions on a short or long case, in which radiotherapy forms a line of treatment, may be given.

The candidate's record book is assessed in the oral examination. This book should contain the complete reports of cases treated by a variety of radiation techniques including internal and external treatment with radioisotopes. 75 marks may be allotted for this book and the discussion on it and 25 for a discussion on pathological specimens and skiagrams, making a total of 100 marks in the oral examination.

The pass marks should be 50 per cent in each written paper, in the clinical as in the oral.

The Higher Degree in Radiology (M.D. or M.S.)

The thesis or dissertation should be accepted by the examiners before a student is permitted to appear in the examination. In addition the candidate appearing for the degree in radio-diagnosis should produce a certified record showing that he has personally carried out all the modern radiological investigations. The candidate for the radiotherapy degree must produce a certified record of the treatments personally carried out by him.

There should in addition be a clinical and an oral examination. The clinical examination should consist of two short cases and one long case (medical and surgical), in which radiology has figured in the diagnosis, or in which radiotherapy forms a line of treatment.

In the oral examination 25 per cent of the marks may be allotted to the discussion of pathological specimens and 75 per cent to an exhaustive test of interpretation of various skiagrams including the clinical and pathological aspects. For the degree in radiotherapy, 75 per cent of the marks should be allotted to a discussion of pathological specimens and 25 per cent to a discussion of skiagrams.

The examiners should be radiologists and the candidate should satisfy them in each of the written papers and in the clinical and oral examinations separately, it being unnecessary to award marks.

degree level. At the diploma level there is an examination in physics and in radiology proper.

During his course, the student usually devotes his time and attention to the topics that figure in the final examination. To make him a practical radiologist the stress must be laid where it belongs, that is, on the practical work done throughout the training period. This object can be achieved if the student maintains a record book of his practical work. This book should carry marks in the final university examination.

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THESIS OR DISSERTATION AS REQUIREMENT (RADIOLOGY)

Dr. K. N. Kamdar

INTRODUCTION

As in other hranches of medieine, so also io radiology, the standard has to he maintained for the postgraduate medical educatioo. Radiology, heing one of the clinical suhjects, should also he of the same standard as medicine aod surgery and it is vital to introduce a system whieh would require a thesis or dissertation to he produced hy the candidate, who is appearing for the postgraduate examination, after having attended the required numher of lectures and having held the required residential post in a recognised institution.

NATURE OF THE THESIS

As the hranches of radiology, viz. radio-diagnosis and radio-therapy, have to be considered separately, the type of thesis would also he differeot, depending upon the hraneh selected. In the diagnostic radiology, the suhjeets may be selected on a prohlem of any subsection, e.g osteology, gasto-enterology, neurology, etc. The theme may be either equipment, modern development in the X-ray maehines or different types of appliances discovered and found helpful for the purpose of diagnosis. Applied physics in radiology could also he seleeted as the suhjeet for this thesis.

In radio-therapy, the thesis may be written on radiohiology, radio-active isotopes, includ-ing cohalt therapy, or high voltage therapy, cooventional radio-therapy or superficial therapy. Here also, applied physics in radiology would be a good suhject to he selected. The quality of the thesis would depend hasically on the student, hut selection of the suhject would be important, depending upon the type of work done at the particular iostitution where the candidate has beeo working.

radiologist at the hospital. The presentation may not be just a report on the records of the hospital. The candidate must give sufficient evidence that he has done good work and has participated in the programme.

ILLUSTRATIONS

This thesis must have adequate illustrations in the form of case-reports supported by clinical data, discussions and comments. It should also include charts, graphs, photographs, line drawings and it might utilise other methods of elucidating the points of discussion

REFERENCES

The citations must be from the original articles of the authors. The common practice of quotations from a second-hand source is not a satisfactory method as it does not really mean that the candidate has understood the original ideas of the authors. If the candidate has read the original articles or the translations thereof he would be in a better position to represent the ideas of the author. In this matter, it may be stated that the services of the Royal Society of Medicine in England or the offices of the USIS, or the British Counsul in India, may be taken advantage of.

The synopsis of the thesis may be made in the form of papers which might be printed in the journals either in India or abroad.

The permission of the head of the institution may be obtained before beginning the work on any project.

A summary may also be made for the same.

POSTGRADUATE EDUCATION IN RADIOLOGY

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IN the management of any patient, who goes to a clinician with the hope to get cured or at least to get relief from his symptoms, the diagnosis of the case is of the utmost importance. For the purpose of diagnosis, perhaps, there is no other single method at present available which is so accurate and dependable as the roentgen method, when it is properly and conscientiously carried out.

In order to carry out this type of investigation properly, the person who is entrusted to perform it must be selected with care. Such an individual should have a sound background and sufficient knowledge of this speciality. We should be able to cope with the increasing advances in the speciality and also keep in touch with the knowledge of other disciplines like surgery, medicine, pediatrics, etc. This does not mean that a consultant in radiology should possess the same knowledge of the other specialities as the specialists of these disciplines. However much one desires it to be so, it is impossible, but what is expected is a good general background of the allied specialities. From experience it has been found that an individual who has worked as a house surgeon for six months in general medicine and six months in general surgery acquires the necessary background. The selected candidate should also have the aptitude for radiology and this seems to be the most difficult to ascertain. However, some idea can be had by interviewing the candidate. It is noticed that the students who acquire a high rank and good position in their undergraduate career usually prefer to specialise in surgery or medicine. *This may be ascribed to many factors. The first and foremost is that the* teaching of radiology at the undergraduate level is so inadequate and meagre, being limited to six to ten lectures, that it fails to impress the student, whereas the teaching of medicine and surgery is undertaken in such an orderly and detailed fashion that the student is easily impressed. Secondly, the prohibitive cost of the equipment and accessories and the difficulties encumbered in acquiring them impose many restrictions on those of moderate means who attempt to do private practice as consultants. The other factor is the lack of a sufficient number of higher positions in this speciality in the public institutions managed by the States. Very few medical colleges in this country have posts equivalent to those of professors in radiology. In spite of all these hostile factors, it is not difficult to find suitable candidates amongst those who have a *natural liking or aptitude for this speciality. Such candidates should* have a sound knowledge of basic sciences such as physics, chemistry, biology and photography.

postgraduate courses in this country, which are in general widely accepted, require a training period of two years. Naturally, the question one asks is: Has the candidate having completed such a course matured into a sound radiologist? Perhaps, no. One cannot deny the fact that a good and able consultant cannot be produced or developed within such a short time. However, those who are in agreement with two years of training try to justify it by saying that the period of two years is more than adequate to impart the knowledge of basic fundamentals so as to develop in the student the qualities of a good specialist. Thus, they bring into the picture the ability of the individual candidate. To whatever extent the teacher may try to train the candidate, the ultimate outcome remains doubtful unless the person concerned takes pains to develop such qualities in himself. Hence, the duration of training does not have any bearing on the training of the specialist. What can be achieved is to create the interest in the student while imparting the knowledge of the speciality. I feel that a candidate should be allowed to study and work for two or three years in the radiology department and when the radiologist decides he should be asked to appear for examinations.

The speciality of radiology has been expanding rapidly in its two main branches—diagnostic and therapy. The diagnostic radiology has many other branches like neutro-radiology, angio-cardiography, gastro-enterology, etc. In each of its many branches, their are newer types of technical procedures and the concepts of interpretation are changing. With this end in view, it would be preferable to extend the period of training to three years instead of two as at the present. But this should be done for all specialities, otherwise the candidate will like to offer for branches of medicine other than radiology. All one desires is to create a specialist whose opinion will be respected by his colleagues in other disciplines and for this purpose the training must be both intensive and extensive.

METHOD OF TRAINING

After the candidate has completed the requisite housemanship he should be registered for the postgraduate course of radiology. What is the best method for imparting adequate knowledge? It is essential that the candidate must become a full-time worker in the department. In the beginning of his training he should be allowed to get acquainted with the various equipment and darkroom techniques. During this period, the physical basis of these should be explained to him. He should also be allotted a subject to work on, with a view to submitting a thesis before taking the examination. Following this introductory period he should watch the reporting on the routine films as well as observe how the treatment on the therapy side is carried on. Much emphasis should be laid on this type of training, because this is the most instructive period when he gets an opportunity to discuss the various aspects of the art of observation and interpretation of findings. Subsequently, depending on the ability of the candidate he may be allowed to interpret and report independently, which reports should be scrutinised by senior members of the department. During this period of moulding, the candidate should also receive didactic lectures. It is felt that the best way of imparting the knowledge would be through the media of seminars, journal clubs and conferences. Such departmental activities make the candidate get acquainted with the theoretical aspects of the subject. Further it also improves expression of thought by the candidate and helps to build the qualities of a teacher. For the

There should be written papers of three hours' duration on each of the above groups of subjects. This should be followed by:

(*a*) Practical examination,
(*b*) Clinical examination, and
(*c*) *Viva Voce.*

Practical examination should bring out how far the candidate is familiar with the technical procedures and their physical basis both in the diagnostic and therapeutic radiology. The clinical examination should be subdivided into the two main branches of radiology. On the diagnostic side the candidate should be given a patient or two for examination so that he should be able to discuss with the examiners the clinical findings as well as the diagnostic procedures. He may be asked to carry out some of these procedures in the presence of examiners if they so desire. Then the candidates should be given one or two diagnostic problems. This can be accomplished by providing a case complete with the history, laboratory data and radiograms. The candidate should be asked to write a complete detailed report on his findings in relation to the clinical background. He should be able to discuss the differential diagnosis and suggest further investigations, which should be applied to him with a view to seeing how far a candidate is able to arrive at a rational diagnosis. The same type of examination should be conducted on the therapy side. The candidate could be given two or three patients for examination, diagnosis, planning of the treatment, writing the prescription, prognosis and what he expects on followup. The *viva voce* examination should be conducted by showing a large number of skiagrams and the candidate asked to discuss the differential diagnosis and rationality of making the final diagnosis of the given cases.

It will be seen that with this type of assessment the candidate gets a good opportunity of showing what he knows and examiners also get an opportunity to know if the candidate is qualified to be a consultant in the speciality he wants to profess. Though this type of assessment takes a long time, it is fair to the examinee as well as to the examiner.

utilised in the training in other basic medical sciences such as anatomy and physiology, biochemistry and pathology. When this speciality was in its infancy, the specialist was considered to be competent in his subject if he was able to interpret correctly the abnormal radiological findings not only in relation to static anatomy but also in terms of patho-physiology. It is not advocated here that the candidate should undergo a detailed study of the above subjects but it would be sufficient if he acquires that much knowledge which is required in proper expression of his own subject—radiology. So it is essential to devote some time to revising the candidate's knowledge of these basic subjects and this can be done simultaneously with the training in radiology. Perhaps, the most important branch of basic sciences is pathology. The radiologist should be conversant with tumour pathology and its clinical behaviour. He is not expected to know the finer details of histopathology but its clinical course, how it spread and its radiosensitivity. Thus, accuracy can be expected from the well-trained specialist in the diagnostic interpretations and therapeutic management of a case. Needless to stress, equally important is the training in biochemistry for the better understanding of the various bone diseases and disorders.

THESIS

The progress of any science cannot be dissociated from research carried out by those who profess that speciality. So as to give a fair idea to the candidate, as to how a particular problem should be approached, he should be allotted a subject to investigate and study further, which he should concurrently submit in the form of thesis. In advocating this type of work one should not expect from the candidate to produce an original work. However, the main aim should be to make the candidate conversant with the methods of research. During the execution of the thesis work the candidate has to study the available literature on that particular topic and compare his data with the available ones. Thus, it initiates in the candidate the ability of experimentation and independent thinking which will be useful in his future career. If the department has, say, six candidates, then simultaneously six different topics are investigated and every candidate becomes conversant with a fair amount of research work.

METHOD OF ASSESSMENT

The object of assessment is to see if the candidate has come up to the standard expected of him on the basis of his training. With this in view, naturally, the first thing to do is to see if the thesis or dissertation submitted by him is approved by the examiners. As pointed out earlier, the aim of a thesis should be to make the candidate familiar with the methods of research. And, hence, if this purpose is served to the satisfaction of the examiners, the thesis or dissertation should be approved.

It will be seen from the above that the subject of the training programme can be broadly divided into the following four groups.

I. Basic Sciences—Physics, Anatomy, Physiology, Biochemistry and Pathology.
II. Diagnostic Radiology.
III. Radiotherapy.
IV. Radiology as applied to other clinical disciplines.

REPORT OF THE SUB-COMMITTEE ON RADIOLOGY

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THERE should be degree courses in the separate branches of radiology, viz. Radiodiagnosis (M.D.) and Radiation Therapy (M.D.).

METHODS OF SELECTION AND REQUIREMENTS

Candidates eligible for this course are those who have spent one year of housemansbip in a clinical department (preferably six montbs in medicine and six months in surgery) after full registration. In lieu of housemanship tbey should bave had not less than two years of service as medical officers in the Armed Forces or in the State Medical Services or in a recognised institution.

Seleetion should be made by the Couneil of Postgraduate Education of tbe university or the college or institute. Candidates should be selected solely on merit after an interview and they should be given stipends for tbe duration of the course. A number of junior posts sbould be ereated which can be held by candidates during the training or immediately afterwards. Not more than four candidates should be admitted for this course in a year.

DURATION AND CONTENTS OF THE COURSE

Duration of the course should be full-time for three years after one year of housemansbip. This period may be reduced by one year for those wbo have a diploma in radiology.

Subjects for the M.D. (Radiodiagnosis) course should Include basie medical sciences related to radiology, namely, physics, radiological anatomy, biochemistry and physiology, pathology (with special emphasis on tumour pathology) and radiology; diagnostie radiology including all types of technical procedures and interpretations; radiology as related to other clinical disciplines. Subjects for the M.D. (Radiation Therepy) course should be the same basic medical sciences as related to radiation therapy; radiation therapy, including use of radio-active substances; chemotberapy and hormone therapy; and radiation therapy as applied to other clinical disciplines.

METHODS OF TRAINING

The method of training for both courses should be through didactic lectures, demonstrations, seminars, conferences and journal clubs. Candidates should take part in the routine work of the department, attend the ward, operation theatre and operation rooms. Candidates for the M.D. course in radiodiagnosis should have a knowledge of reporting, fluoroscopy and

of a candidate be within the field of his speciality, or is it desirable to give him early training and assess him on a larger or broader field by a preliminary examination in general medicine (for medical specialities)? The Medical Council of India have gone a step further to divide the medical and surgical specialities into two categories—for instance among the medical specialities they recommend an M.D. examination for pediatrics, radiology, and anaesthesia but for others, e.g. psychiatry, cardiology, neurology, gastro-enterology, and dermatology, they insist on a preliminary examination in general medicine and subsequently another examination in the speciality. This anomaly is far from being satisfactory or justifiable. It is often asked as to why a candidate opting for the second category of specialities should be required to pass two examinations when knowledge of general medicine is considered essential for all specialities for a broader and wider scope. The anomaly is obvious when in the case of psychiatry and dermatology the specialist is expected to confine his activity to the narrow field of his speciality, whereas those in cardiology, gastro-enterology and neurology are allowed to hold on to general medical beds, examine all medical patients in the out-patients, hold general medicine examinership and are not debarred from filling in an appointment as general physician with a bias for a particular field of work. Why should not then a psychiatrist or a dermatologist be treated the same way?

To cut the argument short, therefore, and to meet the demand for a wider field of interest and competence for all specialities, the following method of assessment is recommended. This method is also helpful in evolving a uniform pattern and standardisation for all specialities, including general medicine and general surgery (which for purposes of further discussion would also be classed as specialities).

1. *That all postgraduates should be trained for a period of 3 years after registration.*
2. That for the first 12 to 18 months all postgraduates including those of general medicine and surgery should have an initial training in general principles and fundamentals of medicine—e.g. a working knowledge of genetics, blood groups, allergy, vitamin steroids, hormones, allergy, medico-surgical emergencies, normal and abnormal histology of organs and tissues, etc.
3. That at the end of this period they be assessed by an examination which may be called preliminary or part one. There may be 3 papers:
   (*a*) One paper on basic sciences.
   (*b*) One paper on fundamentals of medicine.
   (*c*) One paper on therapeutics and investigative procedures.
4. That after the preliminary examination the candidate should devote himself entirely to his speciality and be examined in Part II of the examination at the end. In the field of dermatology such an examination should at the present stage incorporate a combined field of venereology as well as leprology, and further fragmentation of the integrated speciality should be prevented.

METHODS OF TRAINING AND ASSESSMENT

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WITH the selection for postgraduate training of suitable candidates provided with adequate facilities, it is imperative that the training should be very satisfactory. Yet in order to assess the all-round efficiency of a candidate, including his clinical acumen, his intiative and resourcefulness in conducting investigative pursuits, his performance as a would-be teacher, it becomes necessary to sketch out a method of assessment.

EXAMINATION OR NO EXAMINATION?

We can start in this direction by acknowledging two divergent views which are: whether there should be an examination at the end of the course of training, or whether a candidate should be judged by his teacher or guide or group of teachers and guides under whom he has worked during his training? Both these methods have usefulness when properly applied and yet either of them cannot be called flawless. Against the first method, i.e. final examination, the objection raised is that a candidate does not apply his mind widely and freely to gaining knowledge while he is under training. His sole aim is how best to prepare himself for the examination. The objection raised against the second method is that the candidate while under training may know only the methods and their application of his teachers who when they judge him find his knowledge up to date. There is also the question of the human factor, a bias for or against, a factor which is totally obviated if examiners other than his own teacher or teachers assess the candidate.

Much can therefore be said on either side, yet perhaps it is rather too much to assume that, in general, more candidates seriously apply themselves to training methods if they know that they are going to be finally examined and assessed on their performance. Hence most of our educationists, vote in favour of the system of examination with certain modifications, e.g. associating the external examiners who are asked to set the theory papers, with the help of the internal examiner who perhaps guides the external examiner about the scope of such examinations.

If we accept the method of assessing the candidate by an examination then we have to solve further problems with regard to the type and standard of examination; duration of training; integrated teaching with other subjects; prerequisite of knowledge in other fields; preliminary proficiency or examination in some other basic or associated clinical field. To this list can be added the desirability of having a thesis or dissertation or both or none as an integral part of the examination. Some of these points are being covered by others but, so far as methods of assessment in this speciality are concerned, there has been a difference of opinion. Should assessment

DURATION AND CONTENTS OF COURSE IN DERMATOLOGY, LEPROSY AND VENEREOLOGY

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MEDICAL education has been discussed both at undergraduate and postgraduate levels in recent years. Many views have been put forward. What we should not ignore is our obligation to keep the needs of our country and the best interests of our students foremost in our mind. Since Independence, and particularly during the last decade, we have seen a rapid growth of the medical colleges in India. To staff them and other medical research institutes with well-qualified and adequately-trained personnel is the main objective. In addition to this ever-increasing demand of teachers for teaching hospitals, we cannot afford to forget at the same time the needs of our people who are placed far away from the medical colleges in the districts, tehsils and villages of a state. We know that a graduate, i.e. a would-be general practitioner, is not trained enough to handle dermatological work, and we are also aware that we have no specialists at district hospitals to look after these diseases which are quite rampant amongst our villagers. It is, therefore, inconceivable for anyone to imagine that we can keep our health-service running for long without providing adequately trained personnel for these non-teaching district and tehsil hospitals. Our need therefore is two-fold, i.e. (*i*) the need for personnel for training posts, and (*ii*) need for qualified junior specialists to do the work of our health-service. This distinction between the two has to be recognised and it will not be possible to meet both of them by a uniform standard of proficiency or one type of examination only. Hence, in my view, two grades of education and two types of examinations, i.e. doctorate and diploma, are essential. The duration of the former should be three years as recommended by the Committee on Education of Dermatologists, while that of the diploma should be for one academic year.

1. Scope of Training and Examinations

Medicine: Medicine forms an integral part of all specialities including that of dermatology and venereology and it cannot be neglected. But there is a wide divergence of opinion, as to how much of it should be included. I feel I have the support of most of my colleagues if I say that it will not be of much benefit to the students of dermatology if they are made to undergo an extensive training and examination in general medicine before they are allowed to take up M.D. in a speciality.

The advantages of this method are obvious and more or less similar to a primary and a final F.R.C.S. examination. The initial grounding in general principles and fundamentals of medicine (and not general medicine as such) would essentially be imparted to all postgraduates; later on they may pursue the details and intricacies in their specialised fields. It would also mean a uniform period of training, examination patterns and assessment.

In the end it is my earnest appeal to my colleagues and to the colleagues in other specialities and educationists to take a bold step in this direction and give this proposal a fair consideration because this may need some amount of change, but I believe it will be a change for the better.

7. Genetics.
8. Serology and Immunology.
9. Pharmacology.

3. **Teaching and Training in X-ray Therapy**

This should also include the use of ultraviolet rays, infrared rays and other electrosurgical appliances It should last for nearly 3 months.

4. **Venereology**

By tradition and experience the subject of venereology has in most of the places of the world been grouped with dermatology. Syphilogy in particular with all its continuous manifestations during its prolonged course of infection can hardly be spared for study by a dermatologist, and this also applies to other venereal diseases, though not to the same extent. So the demand in some quarters that this subject be taught in a separate way and should have its own examinations does not seem to be very reasonable.

The use of antibiotics and social measures have further reduced the incidence, and the therapy has become so easy of administration that the subject as such cannot stand as a separate *speciality. It would mean greater expense on a field which could easily and conveniently* be amalgamated under the continued speciality of dermatology, venereology and leprosy.

(ii) Secondly, if a candidate has obtained M D in general medicine it will be futile to expect him to opt for a speciality afterwards

What is essential is that he should be conversant with the broad principles of medicine so that he can commence his specialist training in an intelligent way with a good background of internal medicine He should possess knowledge of medicine which should certainly be higher than that of a graduate

This knowledge of medicine can be acquired by attending a postgraduate course in internal medicine for one year or so This grading in general medicine can be further augmented if residental house job in medical wards is made essential for every candidate During this tenure of housemanship the student could spend 6 months in medical wards and for the remining 6 months he can take general training in all the specialities in rotation This will not only provide him more training in general medicine but would also give him an opportunity of having experience in all the specialities, with the result that he will be in a better position to decide whether he wishes to remain a general physician or become a specialist

2 Basic Sciences

Knowledge of basic sciences is also important to enable the candidate to comprehend the background properly This will also help him to acquire a critical outlook towards the subject But the study of basic sciences could also be usefully oriented towards the special subject of dermatology, venereology and leprosy only, and confined to the applied aspects Thus it would be possible for him to go more deeply into details of those parts than he would do otherwise or he had done earlier while he was an undergraduate student It goes without saying that close liaison between various departments and the speciality is essential Some of the subjects in basic sciences may be assigned to students as research projects in co-operation with the related departments of the college and the work may be offered as a dissertation The remaining subjects of basic sciences may be taught by the concerned specialist in collaboration with teachers of basic sciences

Various basic subjects to be included in the curriculum could be

1 Anatomy of skin and its adenexa, nerve supply, blood vessels and lymphatics of the skin and anatomy of genital organs and other related structures
2 Microbiology, i e. study of
   (a) Bacteria
   (b) Fungi
   (c) Spirochaetes
   (d) Viruses
3 Animal parasitology (Insects and other parasites invading the skin along with their life-cycles)
4 Histopathology
5 Physiology of the skin
6 Biochemistry of the skin (e g. histochemical technique of demonstration of amyloid, collagen, reticulum, mucin, enzymes, mucopolysaccharides, keratinization, pigmentation

acquaintance with pathology in general, which will help him in the following months. He will also get an excellent review of general histology by examining several hundred biopsy slides of all kinds. During these three weeks he should study and describe gross specimens, select blocks for micro study, and do his share of examining and describing the micro slides.

The second month in pathology should be spent on leprosy and dermatologic pathology. The stored materials of the department can be used, and intensive study of skin biopsies, under adequate supervision, will be very rewarding. The value will be doubled if colour photographs of the lesions in question are available. Naturally, a variety of "special stains," such as acid-fast, PAS for fungi, etc. are needed. In a month the trainee could review a thousand biopsies. It is not expected that many gross museum specimens of skin diseases, except for a few tumours, will be available, hence microslides and photos must be used.

The student should not drop the microscope into the waste-basket the day his pathology posting ceases: rather, he should now make sure of seeing for himself every biopsy from his patients during the remainder of the two years, indeed, during the remainder of his life.

An assignment in photography may be objected to. But good photographs enable the dermatologist or leprologist to prove what he sees. The trainee may not at present be equipped to take his own photographs, but before long every doctor in India will own a camera, and he should know how to photograph his patients. This art is best learned in a busy photography department where techniques in taking black-and-white and colour, close-up and long distance, day-light, bulb-flash and electronic flash pictures can all be observed and practised. The use of meters, cameras, and films of various types will be learned only by practice under supervision. The results will make dermatology and leprology vastly easier to teach.

A thesis or dissertation is expected of the postgraduate. The topic to be chosen depends partly on him, partly on his professor. But I believe it should be related to his experience. India needs some theoretical scientists, but just now it needs practical men who have seen much and comprehended well. If in the 12th month he chooses the topic of his thesis then the student can work on the subject throuhout the year and finish it off in the 23rd month. The thesis should not be ignored, but it should not overshadow the day-to-day clinical and basic science work and observation.

A month's study leave will be appreciated by all degree candidates and will, I think, raise the pass percentage of university examinations.

What about basic sciences other than pathology and bacteriology? To spend time dissecting cadavers would not be relatively unproductive for this group of students. Physiology in general and biochemistry in particular have as yet little to offer to the practising dermatologist. Pharmacology as related to the speciality will best be learned on the wards rather than in the classroom.

It may also be asked, why so much of pathology? If the specialist wants to read intelligently the future reports from his pathology colleagues, and to discuss them with others, and even to debate with the pathologists, he needs at least two months. I do hope that his distrust of pathologists' reports and opinions will not lead to a total estrangement, as has occurred in some places.

A CURRICULUM IN PATHOLOGY FOR POSTGRADUATES IN VENEREOLOGY, LEPROSY AND DERMATOLOGY

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THE students in this programme are assumed to have at least two years of postgraduate training in medicine and preferably the M.D. (Med.) degree. I shall suggest, merely, for orientation, a schedule for 24 months and then specify in more detail the pathology posting.

Ward work and out-patient clinics in the field of Venereology Leprosy and Dermatology	... Months	1- 6
Radiation therapy	... "	7
Bacteriology and Mycology	... "	8
Pathology	... "	9 & 10
Photography lab.	... "	11
Thesis work (to be carried along also in months 12-23)	... "	12
Clinical work as in months 1-6	... "	13-22
Thesis work (to be completed at end of 23rd month)	... "	23
Study leave	... "	24

I shall not attempt to specify the content of the clinical postings (months 1-6, and 13-22). I should like to point out however that treatment of syphilis covers almost all of the territory of medicine, and hardly needs to be a separate speciality, and treatment of gonorrhea is largely managed by gynaecologists and urologists. Most of the clinical time therefore should be spent on leprosy and general dermatology.

The month in radiation therapy will be very well spent learning the treatment of radiation-susceptible skin tumours. The students must learn therapeutic principles and also cutaneous radiation reactions and the risks of radiation treatment.

The month in bacteriology and mycology will bear heavily on smears from leprosy patients, and the study of bacteria, parasites and fungi found in various skin lesions. It is imperative that the student should know how to do first-class gram and acid-fast stains for himself. The field of mycology is so vast and complex that in a few weeks he will get merely a nodding acquaintance but even so it would be found helpful. Here also he may become familiar with the laboratory diagnosis of syphilis—dark field, serological, treponema, immobilization tests, etc.

The first of the two months in pathology should be spent on routine pathology, a week in the postmortem room to renew acquaintance with anatomy and general organ diseases, followed by three weeks devoted to the day's routine of biopsy specimens. This will widen his

We have found at Vellore that free exchange of ideas among all the clinical firms of the hospital is very helpful. We have a joint discussion of dermatology and pathology every two weeks on the basis of microslide projection. The pathologists are frequently put firmly in their place and all of us learn much. Indeed, we have similar conferences with about ten different clinical firms each week, and to our mutual benefit.

In addition we have departmental discussion every morning. Literature reviews, gross and micro demonstrations of biopsy and autopsy specimens, brain cutting sessions, postgraduate lectures, etc. make this time enjoyable. The dermatology-leprosy student should be a part of such conferences during his pathology posting.

REPORT OF THE SUB-COMMITTEE ON VENEREOLOGY, LEPROSY AND DERMATOLOGY

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THE combined speciality of venereology, leprosy and dermatology, as designated by the Association, was approved by the sub-committee on postgraduate education in these fields. Both diploma and degree courses should be offered. The diploma, however, should not either be a pre-requisite for the degree or shorten the time necessary to obtain the degree.

DURATION AND CONTENT OF THE COURSE

The degree course should continue for three years. The first year should be devoted to study of the basic sciences and general medicine; the remaining two years entirely to the speciality and its ancillary pursuits. The course should include preparation of a thesis, which will expose the candidate to methods of research.

Training in the pathology of venereology, leprosy, and dermatology should include practice in techniques and interpreting results of histopathology, histochemistry, mycology, parasitology and microbiology. Radio-therapy should be studied, and students should develop some proficiency in taking photographs of their own patients. The candidate whose main interest is dermatology should learn surgical procedures related to dermatology. A special unit of dermal plastic surgery in the teaching institution may be useful not only for treating patients but for training postgraduates in dermatology.

Thesis: The writing of a thesis initiates the candidate into the methods and technique of research. He is guided by his teacher to sketch out the plan of his research depending upon the facilities and resources available. He then pursues his work, during which he encounters many difficulties which he himself circumvents in most instances. The postgraduate then reports on his work by drawing references. This involves extensive study of literature; in other words dissertation forms a part of thesis. Further, this reporting of his work has to be done by considering statistical values and thus the writing of a thesis gives him an opportunity to learn the application and value of statistics in drawing inferences and conclusions. Without statistics, the figures and inferences are meaningless. There is no opportunity of learning application of statistics in dissertation. Thesis, thus, introduces our postgraduate to various methodologies of research and trains him to approach a problem in a scientific way.

Dissertation: It involves merely a review of literature which, as pointed out above, has also to be done while writing a thesis. Here the postgraduate merely reviews the research done by others, but he himself does not conduct any research, nor is he introduced to various methodologies of research. Writing a dissertation, unlike, thesis, does not give him an opportunity to visualise problems and learn the technique of research and application of statistics. How can then dissertation train a postgraduate to solve our numerous health problems, which is one of our very important and urgent requirements?

Thus, I feel that to adopt a procedure for having thesis rather than dissertation in our syllabus will be more useful. From what has been observed above, it is quite clear that dissertation forms somewhat of a part of thesis, and is not complete by itself without the candidate taking part in the methodologies of the work. The thesis, I would like to add, should be of a reasonable standard. There is much to be desired in the standard of some of our present-day theses.

The total duration of the course of training for the (a) and (b) types of selection will vary. For category (a) it will be for five years The first two years in this case have to be utilised for clinical training

In the first year of (a) category and in the third year of (b) category, basic sciences should be taught These basic sciences are (i) Neurophysiology including biochemistry, biophysics electronics and endocrinology (ii) Neuro-anatomy including neurohistology, embryology, and genetics (iii) Neuropathology and microbiology, and (iv) general and developmental psychology These courses should be in the form of lectures, demonstrations and practicals.

The next two years are to be spent in the clinical aspects of the speciality, i e

(i) Working up of cases in the out-patients and the in patients departments taking history and doing clinical examination

(ii) Learning diagnostic techniques especially radiological and electro encephalographic. In psychiatry the corresponding instruments and techniques have to be made use of.

(iii) Graded responsibility to be given to the candidate finally to manage the case independently for diagnosis treatment, and follow-up

(iv) In addition to the speciality in which he is being trained, the candidate should spend 6 months in all in other two specialities of this group of neurology, neurosurgery and psychiatry, i e a candidate working for neurology should spend 8 months in neurosurgery and 8 months in psychiatry respectively.

(v) During these years of clinical training the candidate should also be doing work on some research project preferably animal experimental work This should form a subject of his thesis subsequently

(vi) The candidate should either be a scholarship holder on deputation or on the paid staff of the department in which he is working.

(vii) The candidate should be taking part in seminars, journal reviews, grand rounds and the clinical pathological conferences.

The institutions where the specialities are taught have to be recognised by the Universities and the Medical Council of India and inspected every now and then for their standards of work.

It improves the tone of the institution if every now and then a known authority on the subject is invited for a short or long visit.

The assessment of the candidate's achievement has to be made by an examination to be held in the institution where he works and if the candidate is successful he has to be given an appropriate degree in the speciality.

POSTGRADUATE EDUCATION IN CLINICAL SUBJECTS: NEUROLOGY, NEUROSURGERY, AND PSYCHIATRY

DR. BALDEV SINGH

THE main emphasis in postgraduate medical education in clinical subjects is to be laid on the clinical training. It has to be thorough and extensive so as to cover all aspects of the speciality in theory and in practice. This is possible if the following facts are kept in mind:

(i) Adequate and efficient core staff.
(ii) Healthy rapport between the candidate and the staff.
(iii) Satisfactory student to teacher ratio.
(iv) Manageable ratio between student and patients he handles.
(v) Well-equipped departments of basic sciences and diagnostic aid departments. The departments are Radiology, Biochemistry, including Electronics, Pathology, Microbiology, Physiotherapy and Clinical Pathology.
(vi) Research department with facilities of staff, space, equipment, animals, etc. is a must and should be provided.
(vii) A good workshop is a boon, if available. It serves to repair and improvise research equipment.
(viii) Residential accommodation for the staff and students on the campus.

Other factors which need close scrutiny and consideration are:

(1) Proper method of selection of candidates.
(2) Duration and contents of the courses.
(3) Methods of training.
(4) Teaching of Basic Sciences and Pathology.
(5) Thesis or dissertation.
(6) Assessment.

Two fairly workable methods of selection—and there is nothing to choose between them—are based upon two catagories of students. They are:

(a) Those candidates who after doing the house job do M.D. or M.S., as the case may be, preferably with a neurological theme for thesis are eligible to be taken into the speciality training.
(b) Once the candidate is accepted for the speciality course immediately after he finishes his house job.

Admission to the speciality in either case has to be based on a well-conducted interview. Such a selection may involve close contact with the person to be selected for a few days.

Theory papers should consist of (1) questions on basic sciences, (2) diagnostic procedures and pathology including microbiology and (3) clinical methology or neurosurgery or psychiatry as the case may be.

The clinical examination should start with how the candidate takes the case in the outpatients and how he works in the wards and manages its treatment. His criteria of discharging the patient and the follow-up should be looked into.

In the *viva-voce* the general knowledge of the candidate in his speciality has to be judged and also his information regarding the latest advances in his particular field is to be assessed.

The Institute should hold one class examination during the three-year course. This should be held at the end of that year of training when the candidate finishes his training in the basic sciences.

those applicants who have failed more than twice in the postgraduate M.D. or M.S. examinations or more than once in the undergraduate M.B B.S. examination. One failure can be attributed to chance but repeated failures make one cautious. I am not a believer in either a written test or a detailed *viva voce* or interview. If the candidate was not good in medicine or surgery he would not have passed the higher examination. It is impossible to judge the mental and moral calibre of a person in 5-10 minutes. We should lay the maximum emphasis on the opinion of the recommending professor of medicine or surgery, who has closely supervised him. There is a slight but definite risk that some candidates will bring to bear undesirable influence on these gentlemen and get recommendations. We hope that this risk will be negligible.

I am sure, as our numerical strength increases, we will desire that our specialities be recognised as major specialities and the future neurologists, neurosurgeons and psychiatrists should not have to first pass M.D. and M S. (or equivalents) and then obtain further training and pass another examination in the speciality they are going to practise for the rest of their lives. This system was evolved in the U.S.A. Psychiatry in England is now acquiring an independent status. The neurosurgeons are going to argue that learning all the details of cardiological surgery, rectal surgery, and genitourinary surgery are of no use to them when they are going to practise only neurological surgery. I am sure we will also evolve the same system as practised in the *U.S.A.* One year of general medicine or general surgery, after a year's rotating internship and then three to four years' intensive training in the various sub-departments like neuroanatomy, neurophysiology, electro-encephalography, electromygraphy, neuroradiology, neuropathology, neurochemistry, clinical neurology, neurosurgery, and psychiatry. I envisage this change after about five years and then we will be selecting the postgraduates from amongst M.B B.S. graduates.

At the end of this period the candidate would be ready to appear either for an examination or for any other form of assessment that is finally laid down by the university or the Medical Council of India. It would be profitable if he can be encouraged to continue for another year either as a senior resident or as a research fellow, or alternatively be helped on a scholarship or fellowship to travel abroad and work in an institution where fundamental work is being carried on in the field of neurology in which he has shown special interest. Throughout the period of training and specially during the 2nd and 3rd years he should be made to think independently on various problems which confront him, and to try and select a particular field of neurology in which he should attempt to carry out research. This would obviously be possible only if the department in which he is working is active in various kinds of research. Guidance in writing of scientific papers and preferably having him as a co-author on some departmental papers on subjects in which he has put considerable effort would make him feel a part of the unit, which would whet his interest for doing more work and research. If epileptic centres, paraplegic units, and schools for mentally backward or deaf and dumb children exist in a city, he must be made to spend a part of his time in these institutions.

knowledge as he can of these subjects as he would be definitly a better neurologist for this added effort.

Immediately after qualifying in the M.B.B.S. examination, he should be made to spend a year in a general medical (or surgical) department. The second year is divided into 3 monthly periods, when he is made to rotate through four specialities other than neurology or neurosurgery. Having acquired this sound background he starts on his first year of neurological (neurosurgical) training.

In the 1st year of neurology the student should be initiated into three things: ward routine, thorough and careful clinical examination, and recording and interpretation of his own findings. He should be made to learn the correct techniques of neurological investigations, like lumber puncture, air-encephalography, ventriculography, angiography, opthalmic examination, etc. He naturally starts to learn to interpret the results of these procedures from the very beginning, perfecting and polishing his knowledge as experience accumulates. Special stress must be laid on his aquiring skill and alacrity in recognising and dealing with acute neurological emergencies like intracranial hæmatoma, rapidly developing intracranial pressure, respiratory paralysis in poliomyelitis or polyneuritis, intra-cranial sepsis, etc.

In the 2nd year the main stress of the training should be laid on the ancillary services. The student should be deputed to the departments of neurosurgery (or neurology), neuropathologhy, electro-encephalography, electromyography, etc. The details of this year of training may be left to the head of the department under whom the student is resident, but it may be recommended that he spends at least four months in the sister speciality of neurology or neurosurgery, as the case may be. In neuropathology, he should learn how to examine the cerebrospinal fluid, to section and study the normal and abnormal brain, to carry our fundamental staining techniques and histological examination of various common disease tissues. Wherever facilities are available he should be made to learn the importance of chemistry in neurology, as seen for example in the metabolic and genetic disorders of the nervous system. In electroencephalography and myography, he should understand the basic principles of the instruments and the correct method of recording, reporting and interpreting the graphs. It is important to stress here that although the student spends a large part of his time in other units he is still under the guidance of the neurologist (or neurosurgeon), with the result that he still continues to attend at least once a week the out-patients department and the grand round. He also attends emergency duty in the evenings for urgent cases on alloted days by rotation with the other residents. This keeps him in touch with clinical neurology and at the same time leaves him, for a large part of the day, free to attend the other departments and to read and study subjects other than his own subject.

In the 3rd year he comes back to the wards as a senior resident with much greater responsibilities in the actual diagnosis and treatment of the patient. He is naturally now expected to supervise the work of the junior residents and in turn organise the in-patients, out patients and follow-up clinics of the department. He should be given as much responsibility as he can discharge and it is in this year that the depth of his knowledge and training can be assessed.

An efficient and economic teaching in the three fields requires consideration of these areas:

0. Hard realities of the present.
1. Basic quantum of factual knowledge common to these three areas.
2. Essential theoretical knowledge for clinical diagnostic skill for the three areas.
3. Essential technical skill necessary for masterly practice of these three specialities.
4. Essential requisites for inculcating a durable motivation for a devoted and life-long service to the speciality.

These items can now be considered.

0. Hard realities of the present:

1. The absolute shortage of senior teaching staff in these specialities.
2. The proverty of a good allround education of the present-day graduates who seek to become future teachers.
3. Paucity of economic and other incentives which fall outside the purview of the present paper.

These realities impose on us the necessity of concentrating on developing a few centres only to start with where facilities exist for concerted teaching in these three specialities. It is ideal if the candidate could witness and participate in the close functioning of these disciplines in the same institution. Under some circumstances one might be content if facilities are available *in the same city, though the candidate will miss the finer points of teaching and* practice

In view of the poor general educational background of the present-day undergraduate, the postgraduate teacher will have to derise methods of broadening the outlook of his trainee. Seminars on a wide range of general topics, even if held occasionally, should prove to be useful. For instance, knowledge of Indian culture may be quite unnecessary for removing an intracranial tumor, but it is certainly necessary for anyone who aspires for a professorship in neurosurgery with international standing. This is but one example.

ORGANISATION OF POSTGRADUATE TEACHING IN PSYCHIATRY AND NEUROSURGERY

DR. N. C. SURYA

Let us not try to bring the various goals of teaching to a uniform level. Let us rather try to let them blossom side by side. We would be proud to know other opinions but also to have an opinion ourselves.

—Manfred Bleuler.

JUST at present our policy makers in medical education face two problems both requiring urgent solution. First, how to train and provide for this vast country of ours a sufficient number of medical personnel to man the services for the people, and, secondly, how to provide the teacher with facilities for training. It is now generally recognised that it is most uneconomical and unrealistic and even unbecoming to send our young men for higher qualifications to foreign countries.

The theory and practice of modern medicine have become very complex requiring technical skill. Both in medicine and surgery, the concept of the word "general" is losing its significance. The place of specialised services can hardly be disputed and with increasing efficacy of service there are increasing demands from the public for their expansion.

The disciplines of psychiatry, neurosurgery and neurology can be included in the category of recent specialities in our country. A handful of devoted specialists have created the basis and the atmosphere for giving the people an idea of the enormous benefits of these formerly neglected territories of service in our country. The number of young medical graduates thirsting for knowledge in these fields is also on the increase.

The problem therefore is how to pool, economise and canalise our limited teaching resources in these specialities in order that the postgraduate teaching, necessary to turn out a solid second phalanx on the teaching front, may be efficiently carried out.

The pooling together of the three allied disciplines of neurosurgery, neurology and psychiatry is a valuable step. There have been many controversies on the wisdom of such a step but the quotation from M. Bleuler with which my paper starts lays down a sound basis for work in our own country. Both in the clinical diagnostic, therapeutic fields, and in the field of research there is a wide area of interdependence and interpenetration. Temporal lobe epilepsy is one clear example where co-operation is a must. Good neurologic diagnostic skill is essential for the psychiatrist if he is not to miss early signs of an intracranial tumor. In the field of neurology, therapy has hardly any independence apart from what is partitioned as neurosurgery, psychiatry and general medicine. An alert neurosurgeon can hardly dispense with psychiatric help in the research as well as the rehabilitational field. It would serve no purpose to multiply examples.

SUMMARY

The acute shortage of senior teaching staff in the applied neurological sciences imposes the necessity for the healthy practice of integrated teaching with differential training and practice. It will be an enormous saving in men and equipment if M.D. (psychiatry), M.S. (neurosurgery), M.D. (neurology) courses could be conducted in the same setting. Its *importance not only for sound service but also for fruitful research cannot be overestimated.* No future psychiatrist, neurologist or neurosurgeon can afford to practice in isolation much less teach. What better step exists than training our teachers in such settings! In addition to technical teaching, widening of the general intellectual horizons of the postgraduate also is the responsibility of contemporary senior teachers.

separately at separate places one can see the amount of uneconomical duplication or triplication it imposes on our slender resources. Moreover, it might also prove beneficial if subjects like neuroanatomy and neurophysiology were taught by practising neurologists and neurogeons, as also surpsychology by practising psychiatrists. Otherwise there can be a real hiatus between what one learns and then what one faces in actual clinical and operative practice.

2. **Essential theoretical knowledge for clinical diagnostic skill**

3. **Essential technical skill requisite for masterly practice of these specialities:**

These two may be considered as the content of teaching for the next two years During this period the emphasis for the three specialities will naturally differ in content and scope. But at least fortnightly joint clinical meetings and chances of attendance at bedside discussion between the different specialists will highlight the total field and stimulate an inquiring mind into fruitful channels of research. Active participation in ongoing research projects must be a *sine qua non* of postgraduate training. An active neurosurgical centre has a very stimulating effect on the atmosphere of psychiatric and neurologic wards. Such combined units have proved very useful during wartime medical practice and could be so in our practice as well as teaching. The living anatomy and physiology of the brain cannot be learnt on a dead body and neither psychiatric, neurologic nor neuropathologic skills can be said to be complete without periodic attendance at the neurosurgeon's operating table.

It is rather disappointing to note that in our country the tendency is to consider neurosurgery as merely a technique of treatment and it is also unfortunate that neurologists, psychiatrists and others neglect its implications for understanding brain physiology. Brain research minus neurosurgery is an academic exercise in vacuum. I hope this deleterious tendency will be rectified in practice.

If therefore one conceives of M.D. (psychiatry), M.S. (neurosurgery) and M.D. (neurology) in the same setting one not only economises in all essential and costly requirements like E.E.G., X-ray, staff requirement, literary, clinical material, etc., occupational and rehabilitational facilities, but will lay the basis for the creation of integrated teaching units for the future, manned by teams who have already learnt to work together in practice.

4. **Essential requisites for inculcating a durable motivation for devoted and life-long service to the speciality:**

This item would be difficult to cover as a separate entity. However the three years of training in an atmosphere of vigorous inter-disciplinary interaction should create the necessary stimulation if response is not found wanting. During the period of training some facilities should be given to the candidates for undergraduate teaching under guidance. Later on suitable candidates might be given a chance for overseas tour of study. Much more profitable will be invitation to visiting professors for periodic stay and interchange of opinion and practice. Throughout the period of training group discussions and seminars covering not only the technical aspects but also organisational and personality aspects should form part of the training activity of the institute.

a set-up should be adequate for 3 to 4 candidates to be accepted yearly for training. It is desirable that only a limited number of candidates be accepted to enable individual attention to be paid to the trainees. The period of training can be spent roughly in the manner indicated below:

(a) The first year should be spent mostly in the autopsy room and the candidate should acquire the techniques of removal of brain and spinal cord, gross study and detailed descriptions of these organs, and preparation of tissues for microscopic examination. The candidate should also acquaint himself with certain clinico-pathological investigations like examination of CSF, wet smears, frozen section techniques and so on, that are necessary for special study.

(b) During the next two years the candidate will concern himself with reporting on neuropathological material with particular emphasis on neurohistopathology and continuous study of gross abnormalities in the nervous system and of neuroanatomy and neurohistology. Individual responsibilities should be assigned to all the candidates who are under training and reports written by these candidates should be periodically scrutinised and elected by the teachers in the department.

(c) Commencing approximately at about the end of the last period and provided the candidate is sufficiently interested to extend his training further, an independent project for investigation can be assigned to the candidate, for planning and execution. The research investigation will ensure that the candidate keeps himself abreast of current literature and puts to good use the knowledge and techniques acquired over the previous period.

(d) During the latter part of training, the candidate should be associated with teaching and training in the department, e g. the candidate could lecture to undergraduate students either in neuroanatomy or in elementary neuropathology, and in addition, he could also be given some responsibility for training of technicians for the department.

(e) Attendance at clinical neurological sessions should be made essential throughout the period of training. In institutions with large clinical neurological departments, certain definite responsibilities for case taking, examination and care of patients should also be assigned to the candidate.

(f) Other aspects of this training which can be spread out conveniently over the entire period should include gross brain seminars, brain cutting and microscopic slide sessions, clinico-pathological conferences, and a minimum of lectures and lecture demonstrations.

TEACHING OF PATHOLOGY AND BASIC SCIENCES IN THE CURRICULUM

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NEUROPATHOLOGY has been variously defined. A broad concept of neuropathology would include a consideration of abnormalities of the nervous system including under the term abnormalities not only those that are structural but also others where structural changes are not very evident in disease in general. This concept embraces not only changes in the nervous system, in nervous disease, but also reactions of the nervous system in disease and with other aspects of medical sciences. Further, neuropathology concerns itself with two aspects of such a study:

1. Study of the quality of the changes in the nervous system in disease, and
2. Study of the topography of such changes, which is equally if not more important.

Neuropathology thus becomes a link not only between neurology and pathology, but between clinical neurology and neuroanatomy and physiology on the one hand and clinical neurology and internal medicine on the other.

The curriculum in neuropathology will have to take into account the facilities available for teaching and training and the purpose of such training. Certain facilities are required to teach this subject adequately. Institutions that propose to undertake training in neuropathology should have active departments of neurology and neurosurgery, of internal medicine and bio-chemistry, and of pathology and bacteriology, with an adequate turnover of autopsy material. The department of neuropathology should be part of a larger department of neurological sciences (which includes neuro-chemistry), that has much more in common with the neurological specialities than with other aspects of medicine and surgery This department should be staffed and equipped in a manner similar to the department of pathology and biochemistry.

Since at present there does not appear to be a considerable demand for neuropathology in this country, it would be in order to select candidates for training who are referred from institutions or organisations that give assurance of utilising the services of these candidates suitably, after training. It may also be possible to accept a few candidates who opt voluntarily for such training. A candidate for training in neuropathology should have acquired his basic medical qualification and should have completed a tenure of one year in internal medicine and/or pathology. It will be of added advantage if the candidate spends another 3-6 months in neuroanatomy. The training in neuropathology envisaged in this report is expected to last for a period of 3 to 4 years after a candidate is accepted. This will be about the optimum time required in an institution with an annual turnover of about 500-700 autopsies, with 50% to 70% of these including the examination of the nervous system. Such

much in their broad perspective but in certain special details. In a sense, therefore, these candidates after training would become suited only for the special fields for which they are trained. It therefore becomes the moral responsibility of those proposing such a training to see that the candidates who complete the training satisfactorily have assurance of suitable opportunities for utilisation of their special knowledge and training. It is necessary to emphasise this, as it is a sad commentary that despite the fact that there is an increase in the number of medical colleges and institutions which propose to undertake postgraduate training, there are hardly one or two which have established full-time positions in neuropathology. Unless the present state of affairs is rectified, it is pointless to think of details regarding this training.

added advantage for the candidate: he achieves more accuracy than is possible from ordinary clinical and autopsy facilities. Needless to say, the candidate also gets into the discipline of dealing with experimental animals.

No hard and fast rules can be laid down for the formulation of a curriculum in a special subject like this, in this country, but one would like to emphasise that for a neuropathologist to be adequately equipped for the needs of this country it is imperative that the bulk of his training is received within this country, or in other areas of the world, where the pattern of neurological disease is similar to what we see here. The reason for this is that the cross-section of neurological illness is different in our country as compared to what obtains in Europe, the U.S.A. or the Scandinavian countries where neuropathology is taught actively.

It is not unreasonable to expect that candidates who are accepted for training in this special subject desire to know whether they could acquire academic qualifications in this subject, especially since higher academic qualifications play an important part in the selection of individuals for responsible positions. In the present stage of our preparedness, the author feels that it would be premature to institute any special postgraduate degree or diploma in neuropathology. As an alternative, the candidate should be allowed to register for a general M.D. or an M.S. or, in special circumstances, for a research degree like Ph.D. during his training. When our institutions are better orientated for teaching of neurology and basic neurological sciences, and when we have increased the number of teachers and increased the quantum of work, with facilities that are adequate, the question of the institution of a special postgraduate degree or diplomas could be taken up.

It is hoped that the candidates who are accepted for training and who are expected to be employed in neuropathology will he awarded suitable fellowships/stipends, or some other means of sustenance for the period of their training.

An attempt has been made to outline a few ideas relating to training in neuropathology, as a part of the larger curriculum takes the form of an in-service training programme. Didactic lectures or other types of classroom teaching have been reduced to a minimum. It must be emphasised that the principal object of neuropathology is to assist the clinical neurologist in his day-to-day endeavours, and to offer an explanation in terms of neuroanatomical defects for the clinical symptomatology observed during life. The neuropathologist thus is as much a neuroanatomist as a pathologist. The clinical story usually gives enough indication regarding the quality of the lesion, and the skill of the neuropathologist should be directed towards evaluating the neuroanatomical defects,. both primary and consecutive, and to explain neurological symptomatology, in terms of these defects. In this respect, neuropathology differs from other branches of pathology, where the quality of the lesion assumes more importance.

In concluding, the author desires that one other point should not he lost sight of. We train candidates as part of our activities, without being sure as to what we are going to do with this training. Training in neuropathology and in other neurological sciences is an arduous task both for the teachers and the trainees. It involves considerable expenditure of time, money and facilities. As far as the trainee is concerned, it takes him away from the broad area of general medicine or surgery, to a very narrow speciality where things are seen not so

For the present, we may have to do without thesis as requirement, but in the long run there is no doubt that a thesis or a dissertation is most essential to broaden the outlook of the student and also to give an insight into the methods of acquiring knowledge as well as methods of research.

Because of this, it may be better to insist on an increase in the period of training from two to three years and include a thesis or dissertation as a necessary requisite for the post-graduate training in the speciality.

THESIS OR DISSERTATION AS REQUIREMENT FOR POSTGRADUATE STUDIES

Dr. B. Ramamurthi

THESIS or dissertation as a requirement for postgraduate studies is necessary to properly train the candidates and to assess his capabilities. During the period of training in higher specialities like neurology and neurosurgery the candidate must develop the ability to study literature, to collect facts and to assess them properly. In the present situation in our country, it must be remembered that most of the specialists who are being trained in neurology and neurosurgery have not only to be surgical or medical specialists in their own field of work but they have also to become teachers in their specialities. To train a teacher properly, it is necessary that he should know how to gather facts from literature, from his own observations of case material, and then to present them properly in the form of a dissertation. A bias towards research is also essential. One lacuna in the medical world of India today is the absence of small research cells in medical colleges. Without these research cells, it is not possible for the undergraduates and postgraduates to get a proper perspective and they become mere memorisers of facts. Hence to create the atmosphere of research it is necessary to insist on the writing of a thesis by postgraduates in every speciality. This is necessary in the case of a higher speciality like neurology, neurosurgery, etc. Insistence on a thesis or dissertation keeps also the training department in proper trim as it becomes essential for the department to provide all the necessary facilities for the candidate. Hence both from the point of view of the candidate taking the degree and the training department, thesis or dissertation becomes a desirable requirement.

There is a practical difficulty in adopting this requirement as a regular part of the training. For the present, the period of training in neurosurgery has been fixed at two years in some Indian universities. This period may be felt to be too small to learn the speciality and also to present a thesis or dissertation.

In the higher specialities like neurology, neurosurgery, it is thought that a good grounding in basic general medicine or general surgery is essential. As such some universities which have instituted a degree course in the higher specialities have insisted that the candidate who wants to take up a speciality must already possess the degree of Master of Surgery in general surgery or Doctor of Medicine in general medicine. In such cases, the candidate has already submitted a thesis or dissertation as a part requirement for his basic M S. or M.D. degree. So it is felt that it will not be necessary for the candidate who appears for the examination in a higher speciality to submit another thesis or dissertation. As the period of training for a higher speciality is restricted to a minimum period of two years after graduation there is no sufficient time for a thesis also.

These views are cantradictory to what is stated here. Diversity of opinion is bound to exist, but a via media should be found. From personal experience and discussions with colleagues the following scheme for assessment appears to me a very sound one:

Every candidate wanting to be a specialist should be absorbed on the staff of the unit which has been recognised by the local university. Before recognising the unit, the university in conjunction with the specialist association should appoint a board which will visit the unit or hospital concerned and make an impartial assessment of its suitability. Since we are in the early stages of the development of these specialities integrated training can better be imparted in cities where sometimes two or even three different institutions can combine in working out the entire programme, as it may happen that a neuroanatomist is available at only one institution, and a neurophysiologist at another.

Having registered with the university for the specialist training, the candidate should either secure a house job in a recognised neurological, neurosurgical or psychiatric unit or a clinical clerkship which may or may not carry any stipend. The number of clinical clerks in a unit should be restricted to three or at the most four.

For the first year, only routine clinical clerking is done by the candidate who, at the end of the year, is made to sit for a non-university examination arranged by the unit, where 50% marks are reserved for work carried out during the year and 50% marks are for a viva voce on a given case obtained for examination from routine admissions. Only those candidates who secure 70% or more marks should be allowed to proceed for the second year of their training, while the unsuccessful candidates are detained for a further six months to work in the wards. Candidates failing twice should be discouraged from continuing For an unbiased assessment, external examiners should be invited.

For any speciality, knowledge of fundamentals of basic sciences is very important, as this forms the foundation for future growth. Hence, the postgraduate training in any of the three specialities should be assigned to work where the basic sciences can be taught. Both lectures and practical training should be made compulsory, for instance, in anatomy, brain dissections should be carried out by each candidate. In physiology, principles of electricity and electronics should be taught and the candidate should be made to work in the department of electromyography and electro-encephalography. Similarly for pathology. This basic training should be imparted in the very first year of a four-year training programme.

Having qualified in the first-year examination the better candidates should be selected to join as junior registrars and the rest as clinical clerks in the second year. These candidates, though they attend the ward rounds and help in the working of the unit, including research projects, should be allowed to attend the various specialised departments of E.E.G., E.M.G., pathology and for lectures. At the end of this training the university should hold a written examination. Each subject, i.e. anatomy, physiology, biochemistry and pathology, should have a paper of 50 marks to be answered in two hours. Pass marks in each head should be 40% but the aggregate must be 60%. Examinations should be conducted every six months and two trials should disqualify the candidate from proceeding further.

In the third year of training the candidates should do a rotating internship in the departments of neurology, neurosurgery and psychiatry of 4 months each, and attend a lecture course arranged by the university.

METHODS OF ASSESSMENT

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WHAT should be the basic requirements of a candidate, before he starts his specialised training? We have now, in all our universities, internship or pre-registration rotating house job. It is at this stage that the candidate should be allowed to come into contact with the specialised departments. Unfortunately in the institution to which I belong no interns are assigned to work in the departments of neurology and neurosurgery. The candidate having worked in a specialised department can decide for himself whether he would like to take up the speciality as his future career. But prior to joining the specialised department, he should work for at least 6 months in either the medical or the surgical department depending on whether he would care to be a neurologist, psychiatrist or a neurosurgeon. I do not think it is at all necessary to have a full postgraduate training in medicine or surgery and an M.D. or M.S. in general medicine or surgery before taking up the speciality. It is no doubt important to have a thorough basic knowledge of the principles of all disciplines, before undertaking specialised training, as the patient has to be treated as a whole and not disciplinewise. One of my colleagues at K.E.M. Hospital has expressed his views on this subject in the following words:

As for postgraduate education and training in neurosurgery I wish only to add that a prolonged training in general surgery is not particularly desirable for the training of neurosurgeons as our techniques differ so much from those of general surgery. At the same time I feel that the candidate must have a postgraduate qualification which is either an M.S. in general surgery or the F.R.C.S. for which an year in the general surgical ward should prove adequate. There need be no further postgraduate examination in neurosurgery such as M.S. in Neurosurgery as is being offered by at least one university in the country. It seems rather an artificial way of selecting people for senior appointments and to some degree takes away the emphasis from a sound practical training in the subject. One postgraduate examination is distraction enough as it is responsible for breaking up the continuity of the training in the speciality for reasons of study leave, etc. Another examination will result in further break in continuity and cause staffing problems for postgraduate teachers.

Four years in any well-established and fully equipped department of neurosurgery should meet all the requirements of training and qualify a candidate for independent work. It should be possible for heads of departments to weed out unsuitable candidates without undue interference from the administration, and enthusiasm, skill and aptitude should take precedence over mere seniority.

TRAINING LEADING TO CERTIFICATION IN INTERNAL MEDICINE, NEUROLOGY AND DERMATOLOGY IN THE U.S.A.

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PROGRAMMES for training beyond internship in these clinical specialities in the U.S. are referred to as residency training programmes and lead to the award of academic degrees. The ultimate goal of persons engaged in this training is to pass successfully the examination given by the respective American Boards and thus attain a certificate of competence in the field. The authority for approval of residency programmes lies with the Council on Medical Education of the American Medical Association acting in consonance with each of the separate American Boards (Internal Medicine, Dermatology, Psychiatry and Neurology, etc.). Action is taken through Residency Review Committees on which are representatives of the Council and the appropriate American Board.

The programmes are reviewed periodically by surveyors appointed by the Council who report through the Residency Review Committees to both the Council and the appropriate Board.

It is of interest that no statutory body is involved in the review or approval of training programmes; similarly no statutory or academic (i.e. University or Medical College) institution is involved in the examination or certification process. Rather, this represents a voluntary, joint regulation by the practising profession at large and the specialist groups in the public interest. It is our belief that this self-imposed responsibility is one of the great strengths of the U.S. system. It seems axiomatic that the profession is in a unique position to recognise the changing patterns of practice and to promptly adopt them for the common good. Indeed this has been true throughout the history of the programme.

The general standards for programmes are set forth in a document entitled "Essentials of Approved Residencies" promulgated by the AMA Council on Medical Education. In addition to these general principles each of the American Boards set forth specific requirements which institutions must meet before approval of training programmes will be granted. In this way it is possible for training institutions to meet the general requirements which will satisfy all Boards and then fulfil such programmes as its facilities encompass.

In the fourth year the candidate should work on the respective specialised unit, in which he/she is going to specialise and acquire as much technical skill as possible.

During the four years of training the candidate should take up a clinical research project and extra credit should be given to one who produces a good thesis of his own original work, but this should not be a handicap to those who are unable to put up one. Only a small percentage of marks should be reserved for it—say 10 to 20%.

For the *final examination* the *teacher's assessment* of the candidate's work during his tenure should be restricted to 20% of the total marks, as personal evaluations may, quite unintentionally, be biased.

The rest of the examination will then have 60% to 70% marks. This should be divided among three written papers of 3 hours each, and *viva voce* and practicals. The written papers should carry 30% to 35% marks and *viva voce* and practicals should carry 30% to 35%.

In case of neurosurgeons, operative skill should not be judged at the time of examination but a separate confidential report should be submitted by the teacher along with his assessment of the candidate to the examining body.

At the practical and *viva voce*, apart from discussing long and short cases, the candidate should *be made to report on radiograms, gross and microscopic pathology specimens, E.E.G., E.M.G.*, etc.

The question papers may consist of a short essay (one paper), one paper on general medicine for neurology and psychiatry candidates, one question on general surgery for the neurosurgery candidates and one paper on a specialised subject.

The aggregate marks for qualifying should be 70% of the total marks, and in each individual head 40% of marks.

The board of examiners should be appointed by all the universities in joint consultation with the specialist body.

however, that all hospitals participating in graduate training should be able to meet the fundamental essential requirements for an approved programme and either alone or in collaboration should attain comparable *results* in the quality and amount of training obtained."

SPECIAL REQUIREMENTS

I. *Internal Medicine:* This Board offers three means by which candidates may be admitted to its examination.

The first part of the examination under each plan is a written examination, followed, at the convenience of the Board, by an oral examination.

Plan A: Five years of preparation after completion of an approved internship. Three of the five years must be spent in formal training as follows:

1. Three years of residency training in the broad field of internal medicine in an approved programme.
2. Two years of residency training in the broad field of internal medicine in an approved programme and a third year of full-time graduate education in a field related to internal medicine, provided the assignment is an approved medical school hospital or hospital approved for a three-year programme.

The remaining two years in internal medicine may be devoted to work in any clinical investigation or basic science and related to internal medicine.

Plan B: This offers alternatives to graduates of U.S. and Canadian schools not eligible under Plan A.

1. Two years of approved residency in internal medicine. Five years of experience in areas related to internal medicine.
2. One year of approved residency in internal medicine. Two years of graduate education as described under Plan A.
3. One year of approved residency in internal medicine. Eight years of experience in areas related to internal medicine.
4. Eleven years of experience in areas related to internal medicine provided the candidate is identified as an internist by his colleagues in his community.

function in that it serves to improve the quality of medical care offered. Nevertheless this accreditation relieves the Council and the Boards of the necessity for evaluating the standard of patient care so that they may devote all of their attention to educational activities.

The size of an institution is not a primary consideration. The clinical material must be of sufficient diversity to enable residents to observe the principal manifestations of the disease in the understanding and management of which they are acquiring additional experience. The number of beds for service (teaching) patients is however important.

Staff: There must be qualified physicians, not only in the disciplines for which approval is requested but also in allied fields. Some of the general activities in which the staff should be engaged are regularly scheduled meetings, clinical and clinical pathological conferences. Within the departmental scheme in any programme, there should be suitably equipped departments of radiology and pathology headed by qualified specialists. It is expected that hospitals having training programmes will have a high autopsy rate.

A medical library must be maintained and its collection must include carefully selected authoritative medical text-books and monographs and current medical journals, particularly relating to the various branches of medicine and surgery in which training is conducted. Further, the library should be under the charge of a specially trained person.

The medical records department must be supervised by an adequately trained person, preferably a professional record librarian. It is expected that clinical records will be sufficiently comprehensive to permit this use for teaching purposes. Each record must be individually approved by a member of the staff. The overall conduct of the medical record library is the responsibility of a staff committee.

Although the general requirements for persons appointed for residency training are matters of consideration by each Board, since 1st July, 1961, the Council has been expressing disapproval of any programme rosters which contain graduates of non-US medical colleges or schools who do not hold a full and unrestricted state license to practise or a standard or temporary certificate from the Educational Council for Foreign Medical Graduates.

Training Programme: The general requirements are that the programmes should be of sufficient duration and educational content to enable the resident, on completion of his training, to begin the practice of his speciality in a scientific manner. Provision is made for approval, by affiliation, of programmes of less than the usual duration in those hospitals which can make substantial contributions though not offering complete training. A complete programme (usually three or more years) should be such that the resident may get progressively graded experience.

Other matters dealt with include supervision, resident responsibility, methods of instruction, journal clubs, hospital and out-patient service, emergency service, operating room assignments, teaching and investigation, and basic science training. In each of these areas the emphasis is placed on the hospital developing its own staff, techniques of instruction that will permit the best possible use for its own particular material and facilities. In part, the requirements state 'It is hot essential or desirable that all hospital residencies should adopt exactly the same programme, or that they should offer a rigidly uniform sequence of experience. It is essential,

REPORT OF THE SUB-COMMITTEE ON NEURODOGY, NEUROSURGERY AND PSYCHIATRY

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THE sub-committee on neurology, neurosurgery aod psychiatry after discussion of the various problems of postgraduate training in these specialities has made the following recommendations. These are more specificaily applicahle to neurology and neurosurgery since no psychiatrists were preseot at the discussion.

REQUIREMENTS FOR SELECTION TO POSTGRADUATE TRAINING

The coosensus of opioion was that the minimum requiremeot for entraoce into this speciality training should be on M.S. or M.D. degree. The mode of selectino has to be by an interview, takiog into coosideration the previous academie and trainiog record and aptitude of the caodidate.

TYPE OF TRAINING

It was unanimously agreed that the type of trainiog shall be an in-service training programme with graded responsibility and good emoluments. The problem of emoluments is important because of the oumher of years that the candidate has to put in. He has to be at least given the salary scale of a lecturer. In further appointmeots this period has to be considered as teaching experience.

DURATION AND CONTENTS OF THE COURSE

After M.D. or M.S. the candidate should put in two more years in the speciality concerned (which includes allied sciences), after which he may appear for an examination. During this time the candidate should be allowed to take part in the research programmes of the department and should be required to produce at least one good paper. It will be desirable to put in an additional year to round off his training.

METHODS OF ASSESSMENT

Assessment will be by an examination conducted in the candidate's own centre. The examiners should see the candidate at work in his own set-up and assess him to manage on his own the neurological or neurosurgical problems under his care. This will necessarily take not less than three days.

The training in neurology should be based on clinical work on adults and children with neurological disorders, including the neurological complications of medical and surgical diseases. This should be combined with a study of basic sciences related to neurology and include sufficient training in psychiatry to enable the candidate to recognise and evaluate the common psychiatric disorders.

III. *Dermatology:* These requirements are for formal training in dermatology and related subjects of not less than three years. This training may be obtained as a resident fellow or graduate student in approved programmes The formal training shall include at least one year of full-time training in an institution approved for three years of training in dermatology, graduate training in the basic medical sciences and carefully supervised laboratory and clinical work which should include the direct responsibility for in-patient care in dermatology.

I feel that the training in pathology and basic medical sciences will have to be integrated in the regular course in that speciality. It will no doubt be desirable to give a preliminary course of lectures in pathology and basic medical sciences to begin with during the six months of the course.

In my opinion a thesis should be insisted upon. No doubt, there has been criticism regarding the insistence on thesis as it is felt that thesis writing has become a farce being based on very little actual research. However unsatisfactory it may be, since the underlying idea is to initiate the candidates in the methodology of research, we should try our best to improve upon the existing conditions in order to prepare the candidates for the thesis.

The question of assessment is somewhat controversial. It may be asked whether or not there is scope for giving weightage to internal assessment. Can we leave the assessment of candidates entirely to the supervisors. If not, should any weightage in the examination be given to the opinion of the supervisor of the candidate during the final examination. Under the existing conditions it will be better to leave the assessment to the examiners appointed by the university, 50 per cent of whom should be internal examiners. In those universities which have recognised a number of institutions and a number of supervisors for a particular speciality, the question will arise as to who the internal examiners should be. This might either go by rotation or the respective supervisors may act as internal examiners in respect of their own candidates. This is a matter which requires careful consideration.

TEACHING OF CHEST DISEASES

DR. R. VISWANATHAN

CHEST diseases including tuberculosis cause the highest mortality and morbidity rates in the country. In view of the fact that the training programme, whether for the undergraduates or postgraduates, has to be geared to the needs of the country, training in chest diseases has necessarily to be given due importance.

The two specialities of chest diseases and thoracic surgery are closely related in that they deal with the same group of diseases. From the point of view of training of specialists they have to be considered separately—one as a part of internal medicine and the other as a part of surgery.

The methods of selection and the requirements of postgraduates who aspire to become specialists will no doubt depend upon the type of training that is proposed to be given. In so far as the speciality of chest diseases is considered, at present there is a diploma course of one year in many universities. In Delhi, the diploma course gives equal importance to training in chest diseases and in tuberculosis. In other places the course is limited only to tuberculosis.

So far as the diploma is concerned, the requirements for a candidate admitted to the coursa can ordinarily be rotatory house surgeoncy, of which not less than three months will be in internal medicine. Exemption from the rotatory house surgeoncy can be given to the candidate who has been working either in a chest department or in a tuberculosis institution for over a year. Selection, no doubt, must be based on merit.

Some of the universities in India award M.D. in tuberculosis. Whether this is desirable is a matter for consideration. It is also worth while considering whether there should be an M.D. degree in chest diseases including tuberculosis. This will no doubt enlarge the scope of training. The committee can also consider the question whether training in the speciality of chest diseases and/or tuberculosis should be given after the candidate has taken his M.D. in general medicine.

As regards thoracic surgery, the point for consideration by the Committee is whether training in thoracic surgery should not be given after a candidate has taken M.S. in general medicine. Thoracic surgery will no doubt include both lung and heart surgery.

All diploma courses should be only of one year's duration. For a degree course the duration should not be less than three years after completion of one year of house surgeoncy, of which at least six months should be either in internal medicine or in surgery depending upon whether it is for the speciality of chest diseases or for thoracic surgery. During the three years of the course the candidate will work for one year in general medicine or general surgery and for the remaining two years in the special department concerned.

Emphasis should be laid on practical experience. This does not mean exclusion of the regular course of lectures and demonstrations.

would rather regard thoracic surgery as general regional surgery which comprises a great many *disciplines: handling of lungs, vessels, nerves, bone work* and *every thing* that *pertains* to the contents of the thorax. In other words, it is not dealing only with one system. The thoracic surgeon must be trained in all the various departments of surgery to have adequate experience for his future complex work. In addition, he has to be an experienced endoscopist, and he has to acquaint himself with the new techniques of hypothermia and perfusion.

The general view expressed can be summarised as follows, although at certain points there were differences. A candidate must satisfy the following conditions:

(1) He should possess a complete training in general surgery.
(2) He should have passed a year in a laboratory of experimental surgery and during this period have acquired solid fundamental notions, of normal and pathological anatomy, normal and pathological physiology, biochemistry, etc.

A minority view expressed was that a candidate should have spent at least a year in a specialised service of internal medicine doing Heart and Lung work. The majority of them were of the view that the training after general surgery should be for four to six years.

I think the programme of each country must be geared to its needs. We must not imitate highly developed countries where thoracic surgery has almost become a synonym for cardiac surgery. In our country the problems posed by tuberculosis and pulmonary parasites, empyema, lung abscess, etc. are far more important than cardiac surgery.

Training in surgery ceases with death or retirement. Our ideals in any training project should be the practical factors of time, age and economics. What we want *is to give a man* a proper and adequate experience and make him fit to have charge of patients. We do not want to go on with training schemes that carry a man into middle age. Moreover, I think the evolution of thoracic surgeons must necessarily come from general surgery. It is my view that *thoracic surgery is not a course but it is a process of evolution. This applies to practically all* specialisations and moreover depends on the character of the individual and the opportunities offered to him. I feel that a surgeon branches out into a speciality according to the demands as well as his nature. I feel a person who has an artistic sensibility and has patience to apply *stitches over and over again, taking them off slowly, finds himself doing* more and more *plastic* surgery. Similarly, a neuro-surgeon is a personality who is endowed with the distinct quality of a placid nature. Constant dead lines and failures do not seriously burden his conscience. An orthopaedic surgeon, on the other hand, is the one who is fond of moulding and shaping and his nature is like that of a carpenter in surgery. A thoracic surgeon is a bold and quick worker, an extrovert by nature, and is able to take snap decisions when he is in a tight corner. For him delay in taking a decision by a fraction of a second might mean the life or death of a patient. I therefore feel that a thoracic surgeon should evolve from general surgery, and a cardiac surgeon should evolve from thoracic surgery. I feel that one year as an Intern and one year as a House Surgeon with a short period in medicine should be the basic requirements for general surgery. He should then do a period of two to three years at a minimum in general surgery. Here, he gains experience and increases his knowledge. If it is possible to

DURATION AND CONTENTS OF COURSE OF TRAINING IN THORACIC SURGERY

DR. S. K. SEN

THERE is no end to the ways by which surgery has been, or can be, segmented—all with some valid reason—but when we consider the consequences of these segmentations we must always have before us two facts.

First, surgery is not static either in its scientific background or in its application. On the one hand, occasions will continue to arise—circumstances of time and place—which shift the relative accent of interest and attention as between one speciality and another. The simple law of supply and demand on surgical service will always restrict the work of many surgeons in this or that field. It is in that way that modern surgery reaches its highest flights, and the development of this speciality is an outstanding example of this.

On the other hand, whatever is developed by individuals or by groups in a particular subdivision of practice will, by teaching and influence, be continually re-absorbed into the general spectrum, at least in some measure. It is encouraging to note how procedures which were developed by specialists, or which were only carried out by specialists, are being practised more and more by the general body of the younger surgeons. This does not put *bona fide* thoracic surgeons out of business for they will continue to develop new lines and seek fresh opportunities for the application of their experience and techniques. To this process there is no end, for it is a natural evolution of events. Furthermore, as new developments come along, what has been an established line of practice in one era may be eclipsed in the next. I, therefore, think that in thoracic surgery, as in any other speciality, the dividing line between the general and the special field is fluid. In fact, there is no line. That is the first point we must realise when we have to consider the problem of training in various specialities

The second point to note is that all special branches of surgery are arbitrary subdivisions which not only vary with time and place, with supply and demand, but also with personalities and opportunities afforded to them. These arbitrary subdivisions can exist harmoniously only if it is accepted that there are no strict boundaries and no proprietory rights.

Before embarking upon specific ideas about the duration and content one must be satisfied with what one is talking about. I think it is desirable to delimit the subject with precision. Actually thoracic surgery comprises the surgery of the lung and the mediastinum, cardiac surgery, and what one might call thoracico-abdominal surgery—stomach, spleen, suprarenals, oesophagus, pancreas, and finally the surgery of thoracic and thoracico-abdominal injuries.

I had the good fortune to attend a seminar on training in thoracic surgery in Rome in 1963. The seminar was led by Prof. Rudler of Geneva, and attended by Bentall, Brom, Chalnot, Cleland, Dubost, Gerbode, Gottlob, Holmes-Sellors, Husfeldt, Kirklin, Senning, Valdoni and Tenker. Sir Thomas Holmes-Sellors made a point which I think is relevant. He suggested that to call thoracic surgery a speciality is using it in a very narrow sense of the word. We

METHODS OF POSTGRADUATE TRAINING IN CHEST DISEASES

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Professor of Tuberculosis and Director, Institute of Diseases of Chest and Tuberculosis Hyderabad

TUBERCULOSIS, the commonest of all major chest diseases, is also the greatest single public health problem in India today. The National Tuberculosis Control Programme attempts to integrate the tuberculosis case-finding and treatment into the general health services in order to achieve the maximum case-finding and treatment coverage through the staff of the existing health facilities and general medical practitioners. This may at first give the impression that specialists in tuberculosis are no longer required and that postgraduate training in the speciality is unnecessary. This is not true. We do need specialists at all key posts such as the district tuberculosis control centres and the State tuberculosis demonstration and training centres to plan and direct these programmes and also highly specialised and experienced teachers and research workers for training the postgraduates. Further, apart from specialists, for the proper and effective implementation of the programme, it is also essential that all practitioners of modern medicine should have the basic knowledge and interest in the various aspects of tuberculosis and other diseases of the chest and in the control programme. This basic training in tuberculosis and chest diseases, therefore, should begin at the undergraduate level. Although this paper is on postgraduate training, it is, nevertheless, considered important to mention a few points regarding the training of the undergraduates in chest diseases, particularly in tuberculosis.

Undergraduate Training

Teaching of undergraduates in tuberculosis as well as other chest diseases should be in the special department of tuberculosis and chest diseases of the medical college and the teaching programme should be entrusted to the professor of tuberculosis and chest diseases. The State Tuberculosis Demonstration and Training Centre should be attached to the medical college. The duration of practical training in the fourth or final year should not be less than one month, of which two weeks should be at the State Tuberculosis Demonstration and Training Centre or the District Tuberculosis Centre as the case may be. This practical training should be supported by 12 didactic lectures in tuberculosis in addition to the lectures in other respiratory diseases as part of the general medicine lectures by the professor of tuberculosis and chest diseases. The professor of tuberculosis should have at least 30 in-patient beds for teaching purposes. There should also be a full question on tuberculosis or other chest diseases in the medicine paper and the professor of tuberculosis and chest diseases should be included as one of the examiners.

rotate him in this period in urological, orthopaedic and rectal departments, he would gain probably such general training as is possible.

In his line afterwards he for one or two years becomes a senior Registrar or Chief Assistant of a general surgical department. This appointment should give him 90 per cent chances of becoming an independent surgeon. Then, if he desires or is found suitable, he should be switched on to a speciality, like thoracic surgery. He should be prepared, if he switches to this speciality, to work at a lower level, and work for two or three years at a junior level, and later be promoted to a senior level, where he will be a chief resident and work there for two years. He will have to live in the hospital to learn the special techiques, e.g. investigations, aspirations, endoscopy, fluoroscopy, care of perfused patients, and so on. As he becomes a senior assistant or a chief resident, as it is designed in the U S., he should be more and more responsible and should have done without supervision a certain number of lung and heart operations. By the time he has finished two years of junior and two years of senior residency, he should be promoted to a Consultant's rank to take charge of patients unsupervised. During the period of training he may work in a Specialist Department. He will learn, if he has not already learnt, to appreciate the value of being a member of a team, and realise that, an individual though he may be, he will never be divorced from the team work in collaboration with physicians, radiologists, anaesthetists and other colleagues

One other point which I should like to mention, because it may be particularly applicable to our country rather than to others is regarding the words "experimental surgery." We feel, there are many people who are capable or willing and able to do experimental work. We do not think that this should be continued to be applied to young thoracic surgeons It may be that he has a bent for experimental work, then, he should have full facilities for this phase of surgery; if he does not have the inclination, it may be a mistake to force him to the laboratory for 6 or 12 months. He should explore the field of clinical research. I am not denigrating research but I submit that it is an expensive hobby and every one under training is not fit to undertake research. In most cases it is a waste of valuable time and money.

We are working against time. In all these things, we should like a man to do as much practical work as possible. We should also like him to carry out research and fulfil his ambition. As soon as we feel that his training is adequate to justify his independent status as a Consultant, we should let him go.

surgical training for M.D. (Chest) candidates need not be elaborate and only indications of surgery, selection of cases and pre- and post-operative complications and management need be taught. This can be arranged with the thoracic surgical department. Not more than five post-graduates for M.D (Chest) should be registered with one professor. Didactic lectures should be reduced to the minimum and emphasis should be on seminars, clinico-pathological conferences, bed-side clinics, clinical demonstraions and field work in tuberculosis.

The paper gives only a broad outline of the months of training and hence no details have been considered which can be worked out by the respective institutions.

Postgraduate Training

At present there are two types of postgraduate training in tuberculosis and other diseases, viz.:

(a) Diploma course of 9 months to one-year duration (T.D.D.—Tuberculosis Diseases Diploma—or D.T.C.D.—Diploma in Tuberculosis and Chest Diseases).
(b) Degree courses—M.D. (Tuberculosis) or M.D. (Chest Diseases).

Diploma Courses

The duration of training should be one year, of which the first three months should be spent in the medical college and in the general hospital to undergo training in basic medical sciences such as applied anatomy, physiology, pathology, bacteriology, social and preventive medicine and non-pulmonary tuberculosis.

Three months should be spent as internee in a chest hospital to study the different diagnostic and therapeutic procedures including thoracic surgery. The professor of tuberculosis should necessarily have a unit in the hospital. (This obvious point is mentioned because in some of the existing postgraduate teaching centres the professor of tuberculosis of the University has no unit in the chest hospital, indeed, no in-patient beds at all.)

The last six months should be spent at the State Tuberculosis Demonstration and Training Centre to learn the community approach in the control programme, domiciliary treatment, methods of record keeping and assessment. Didactic lectures should be of the minimum and emphasis should be on diagnosis of chest diseases, chemotherapy, domiciliary and community programmes, etc. During this period, a visit to the National Tuberculosis Institute, Bangalore, and Tuberculosis Chemotherapy Centre, Madras, is desirable as is now being done by some universities.

M.D. (Chest) or M.D. (Tuberculosis)

A candidate appearing for M.D. (Chest) should have a thorough knowledge of general medicine, including fundamentals of medical statistics and research methodology, in addition to high proficiency in all aspects of the speciality of chest diseases and tuberculosis. The total period of training should, therefore, be three years, of which the first year should be in rotating housemanship in all the departments of medicine as for M.D. in any other speciality. The remaining two years should be spent in the department of tuberculosis and chest diseases. During this period, training should be given in applied basic medical sciences for three months in the respective departments and, in non-pulmonary tuberculosis, for three months in the general hospital. Of the remaining 18 months, the first year should be residential at the chest diseases hospital where the candidate works for his thesis and receives practical training in the diagnosis and treatment of all cases of chest diseases including fundamentals of thoracic surgery. The remaining six months should be spent at the State Tuberculosis Demonstration and Training Centre to receive training in the epidemiology, domiciliary care and the various aspects of the national tuberculosis programme. During this period a visit to the National Tuberculosis Institute, Bangalore, for one month and to the Tuberculosis Chemotherapy Centre, Madras, for two weeks should also be arranged. It is also desirable to arrange a visit to the Patel Chest Institute, Delhi. Thoracic

Mycobacteria-morphology; growth requirements; antigens; cytochemical tests; virulence; drug action; immunity to tuberculosis; classification; anonymous mycobacteria; streptococci and respiratory infections; pneumococci and pneumonia; staphylococci and lung lesions; haemophilus and respiratory disease; klebsiella and enterobacterial disease of lungs; corynebacteria and diptheria; bacteriology of chronic bronchitis; pleuropneumonia; new trends in immunology; hypersensitive states; microbiology of air; viruses, general properties, growth and classification, diagnosis; respiratory viruses; adenoviruses and respiratory diseases; enteroviruses and respiratory infections; rhinoviruses; other viruses affecting the respiratory tract.

Practicals and demonstrations

Preparation of media; microbes around us and staining methods; sputum examination; mycobacterial cultures; animal tests; faeces culture for tubercle bacilli; urine culture for tubercle bacilli; CSF culture for tubercle bacilli; sensitivity tests; streptococci and staphylococci; pneumococci; sputum culture, entero bacteria; corynebacteria.

3. *Medical Mycology (Lectures and demonstrations)*

Classification of fungi and some common saprophytic fungi; laboratory diagnostic methods of fungal diseases; collection and handling of clinical materials and their subsequent examination in the laboratory.

Diseases caused by actinomycosis; nocardiosis; yeast-like fungi, cryptococosis; candidiasis, by dimorphic fungi; coccidioidomycosis; histoplasmosis; blastomycosis; paracoccidioidomycosis, by mycelial fungi; phycomycosis; aspergillosis; allescheriosis.

4. *Pathology (Lectures and practicals)*

Micro structure of lungs.

Pathology of acute and chronic inflammation; pulmonary tuberculosis; bacterial pneumonia; viral pneumonia; bronchiectasis; lung abscesses; pulmonary thrombosis, embolism and infarction; congenital abnormalities of the lung; extra pulmonary tuberculosis; pulmonary fungus diseases; chronic bronchitis and emphysema; pneumoconiosis; chronic pulmonary hypertension and, cor-pulmonale; pulmonary diseases of uncertain etiology; tumours of the lung; cytological procedures in lung diseases.

5. *Biochemistry (Lectures and demonstrations)*

Protein metabolism; carbohyrate metabolism; lipid metabolism; enzymes; chemistry of tubercle bacilli; biochemical changes in tuberculosis and other lung diseases.

BASIC SCIENCES IN THE TRAINING PROGRAMME IN CHEST DISEASES

DR. N. P. GUPTA

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A postgraduate training programme has to be adjusted to the needs of the country, requirements of the discipline itself and to the level of training programmes of undergraduates and pre-medical education. It has also to be in alignment with similar postgraduate training programmes in other disciplines.

2. No training programme, therefore, can be copied from another country. Also the programme will require constant and periodic revision.

3. No sharp differentiation is possible between the trainings of a diploma and a degree student. The latter has to study and undergo training in the subjects but the nature of training is different. The degree student has to know the basic concepts. In addition, he has to familiarise himself with research methods, new trends and controversies in the same subject. He has to have a critical grasp of the subject in addition to being familiar with it which may be considered enough for a diploma student.

4. Admission to M.D. or M.S. should be limited to those who have done their diploma course.

RECOMMENDED TRAINING PROGRAMME

1. *Anatomy and Physiology (Theory)*

Anatomy of lungs, mechanics of breathing, pulmonary exchange, acid base chemistry of blood; control of breathing, recent advances in the study of physiology of pulmonary circulation, protective mechanism of respiratory system; functional concepts of dyspnoea; pathophysiology of diffuse airway obstructive diseases; alveolar hypoventilation syndrome; alveolar-capillary block; pulmonary haemodynamics in various lung disorders; functional disturbances of corpulmonale; effect of thoracic surgery on lung functions; respiratory failure; classification and patho-physiology of respiratory failure; physiological basis of treatment.

Practicals and Demonstrations

Study of lung volume, study of mechanics of breathing, including compliance, airway resistance and inspired air distribution patterns; acid base chemistry of blood, including percent, saturation, PO_2, PCO_2, pH and alkali reserve estimation, estimation of diffusion of gases, study of pulmonary haemodynamics.

2. *Microbiology (Bacteriology & Virology), Theory*

Respiratory Microbiology—a survey

and studying a series of cases personally, reading literature relevant to his cases, and then writing a discussion or dissertation on his subject instead of writing a thesis. Those who favour such a procedure argue that in the limited time of two years it is not possible to submit a research paper as thesis and simultaneously to undergo sufficient higher clinical and laboratory *training and to study relevant world literature*. They seem to think that the emphasis should be on the training—clinical, laboratory and relevant literature—rather than on new observations, new approach, or newer knowledge. Research cannot be made to order and to yield results in a limited period of two years—the more important is training of the candidate for research work, for higher teaching, and for the development of higher clinical acumen and judgment.

Protagonists of thesis and of dissertation place importance on different aspects. The former put the emphasis on research. Unless a candidate shows and proves his research ability, according to them, a candidate is not to be considered fit for a doctorate or a master's degree *The votaries of dissertation argue that research is not easy and cannot* be made to order. It will be more fruitful to utilise the postgraduate period of training to improve the candidate's clinical observation and grasp of a problem, and devote his time to detailed and advanced study of relevant literature.

Lack of research in the medical field in India is a noticeable feature. Research is bred and nurtured in universities in the vast majority of cases, but also in private laboratories in a few instances. A Domagk or a Subba Row may occasionally flourish in private laboratories, but the Nobel-Laureates *in medicine have mostly come from universities. Universities* must encourage and nurture research. But the immediate needs of a country are paramount. To *create doctors and to man the growing number of medical colleges (at present it is 82; at* the end of the Fourth Plan it is envisaged the number will be 100) it may be necessary just for the present and for some time to put the emphasis on a rapid training of medical educators. Our postgraduate degrees may be orientated temporarily for such an emergency. But dissertation may encourage cramming, and not free thinking and research.

If it is considered desirable to have more postgraduate qualified doctors to man our growing medical colleges, and to make these qualifications more easily obtainable, it will be *justified to substitute a dissertation for a thesis for acceptance for M.D. or M.S. degrees*, and to hold a high-level theoretical, clinical examination and *viva voce* to ensure a high standard. The dissertation must be submitted and scrutinised before allowing the candidate to sit for his examination. The candidate may even be made to appear before the moderators at the time of his examination to defend his dissertation, and satisfy them.

If, however, a high level *original work* and *personal observation (thesis) is envisaged*, the candidate may take a longer time to prepare and submit it. He may appear in his theory, clinical and *viva voce* parts of the examination after a course of hard clinical theoretical and laboratory grinding earlier, and submit his thesis at a later date within five years from the date of this earlier examination. Only on the completion and acceptance of his thesis will the degree *of Doctor or Master be conferred on him.*

DISSERTATION VERSUS THESIS

DR. P. K. GHOSH

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THE qualifying examination in medicine is the M.D. in many countries. In India, the qualifying examination is M.B.B.S.; and M.D. is a postgraduate doctorate examination. In admitting a candidate for a postgraduate doctor's or master's degree (M.D. or M.S.) it may be justifiably expected that he is above the average. After his admission he is trained to better his clinical acumen and judgment to diagnose and understand any case better than others of his profession. He may be trained to become an educator, and teach and guide students in future. He may be encouraged and trained to solve problems and become a research worker. He may also be trained to become a good administrator. Our aim and object in training a student for a postgraduate degree—a doctorate or master's degree—is to train him to improve his power of observation and deduction and to encourage him to probe into the why's, what's and how's of cases.

At the initial stage, a candidate for such higher degrees is required to observe and follow a series of a sufficient number of cases personally with clinical and laboratory data in detail—biochemical, biophysical, micro-anatomical, or any other relevant investigations as he thinks desirable, or, as his guide directed him. He has to systematise his observations, enumerate, and tabulate them, and draw inferences which will add new knowledge or lead to better understanding of some problems.

It takes about a year, or a year and a half, or even more, for a candidate to observe and follow a series of cases, tabulate his data, study his problem, study relevant literature and draw his conclusions. The candidate is expected to work under a guide who discusses with the candidate and chooses his problem, guides him in his work and helps him with references. The preparation of thesis is usually a whole-time job for two years or more requiring hard work for the completion of the investigations and the writing of the thesis. During this period he is also expected to attend a series of postgraduate lectures, to attend wards, study and discuss cases—to get the higher clinical training. The thesis is generally submitted in triplicate and is sent to three specialist moderators and their opinions obtained separately. The majority opinion decides whether the work and the thesis are adequate for acceptance. When this opinion is known and conveyed to the candidate, then only the candidate seriously begins to work for other parts of his examination—theory or paper, a gruelling clinical test, and an exacting *viva voce*. If the thesis is not found adequate, the candidate has to re-write and re-submit his thesis after consulation with his guide.

The preparation of a thesis entails hard work and is time-consuming. Even then the thesis may not be very revealing or of high academic value. The question which gives trouble to the educator is whether this labour and time may not be better utilised in observing

Assessment

The candidates would be assessed by an examination which will consist of written, practical, clinical and oral parts. At least 50 per cent of the examiners should be external.

DEGREE COURSE

The minimum qualification for admission to the course of training in this speciality is M.D. degree in general medicine.

The candidate should have preferably submitted a thesis on a problem pertaining to chest diseases for his M.D. He should have continuously worked under a recognised specialist for at least three years. During this course he should have done research work under the supervision of an expert and published at least one paper based on his own original work in a standard medical journal. The candidate will be expected to appear for an examination conducted either by the University or by a National Certifying Board. The examination will consist of clinical and oral parts. The successful candidate will be awarded the degree of D.M. The supervisor should also be included as examiner for the candidate.

THORACIC SURGERY

The Committee is of the view that thoracic surgery should also include cardiac surgery. Actually thoracic surgery comprises the surgery of the lung and the mediastinum, cardiac surgery, and what one might call thoraco-abdominal surgery: stomach, spleen suprarenals, oesophagus, pancreas and finally the surgery of thoracic and thoraco-abdominal injuries.

In this speciality there should be only one course of standard training leading to D.M. The basic qualification for admission to the course will be M.S. in general surgery. It will be preferable for the candidate to have worked on a problem in thoracic surgery for his thesis for M.S.

The candidate will be assigned to an experienced, recognised thoracic surgeon. He will work under his supervision for a period of at least three years.

During the course of training the supervisor should arrange for the candidate to get adequate experience in all aspects of training including training in cardiac laboratories.

During the course of training he should publish at least one paper based upon his own original work in a standard medical journal.

The candidate should be given graded responsibility in surgical procedures so that at the end of the course he should have performed independently all major operations in this speciality. At the end of the course the candidate will appear for an examination conducted by the University or a National Certifying Board as the case may be. The successful candidate will be awarded the degree of D.M.

REPORT OF THE SUB-COMMITTEE ON CHEST DISEASES AND THORACIC SURGERY

DR. R. VISWANATHAN

Chairman

THE Sub-committee regards Chest Diseases and Thoracic Surgery as separate specialities; hence the two subjects are considered in different parts.

CHEST DISEASES

Training in the speciality will have to be considered from two angles: manning the medical care and control services pertaining to this subject, and providing teachers and research workers. The committee therefore felt that there should be a diploma course for the former and a degree course for the latter. The requirements of the two courses are given below.

DIPLOMA COURSE

Because of the very great importance of tuberculosis in the country, the training in that disease should be given support and importance and hence the diploma should be named Diploma in Tuberculosis and Chest Diseases.

Admission Qualification

The student must be a medical graduate and should have completed one year of compulsory housemanship. He must have done six months of housemanship in general medicine and six months in chest diseases or tuberculosis, or spent twelve months of housemanship in the chest department of a tuberculosis hospital, or had three years in medical practice.

Duration of Course

The course will be for twelve months, of which three months will be devoted entirely to clinical clerkship. The examination may be held either at the end of nine months or at the end of twelve months.

Courses

The course of training should be equally divided between non-tuberculous chest diseases and tuberculosis. It will include training in basic medical sciences pertaining to this speciality, consisting of practical laboratory training, lectures and demonstrations. Throughout the course the students will undergo clinical and public health training. Training in tuberculosis will include pulmonary as well as non-pulmonary diseases. Emphasis should be on the medical aspects. For a diploma course, the committee felt that neither a thesis nor a dissertation is necessary.

CHAIRMAN'S OPENING REMARKS

THE medical student nowadays knows more fully than any generation of physicians before him that his education does not terminate with the M B.B.S. degree; indeed to be worthy of the title "physician," he must look forward to a lifetime of learning. Thus, several years after lawyers and other professional men have profitably begun their careers, most physicians are still engaged in formal study. And, throughout their years of practice, physicians must find ways to keep abreast of scientific developments in their field and to apply newly found knowledge in their daily work.

Postgraduate education is presented by one year of internship, perhaps the most fruitful period of a doctor's professional life. In a hospital, the young doctor assumes the full stature of a physician, receiving and accepting responsibility for the immediate care of the sick, and putting to practical use the facts he has mastered during many years of study. His work to be sure, is carefully observed and guided, but the internship is the first test of his ability to deal conscientiously and effectively with the sick.

Time spent in internship enables one to gain experience and medical students generally seek appointment to a hospital where a wide range of educational opportunity is available. The size and nature of the hospital, the quality of the professional staff, the degree of responsibility afforded and the amount of teaching provided are factors which influence their choice. The fact that the educational experience is given priority partly accounts for (but does not justify) the financial sacrifices made by the interns.

The hospitals which are affiliated to medical colleges are, for obvious reasons, taking a leading role in postgraduate education, and would in due course assume most of the task.

The role of the intern has taken on added importance in recent years. The complexities of modern medicine as practiced in large hospitals may bring insecurity or fright to some patients; even those who are quite sophisticated in medical affairs may suffer anxiety in the fast moving, impersonal world of the hospital. The intern has the opportunity and the responsibility to be not only his patient's doctor, under supervision, but also a friend and an adviser. The mutual trust which develops between them makes the hospital atmosphere more suitable to the patient's complete recovery.

Internships are either "straight" (served in one department), or "rotating" (served in several departments). In the rotating internship, which in a few instances lasts two instead of the customary one year, the doctor can gain experience in several departments like medicine, surgery, pediatrics, gynaecology-obstetrics and psychiatry, in order to prepare himself for general practice or for specialisation later on. Straight internship is usually taken in one of the five fields: medicine, surgery, pediatrics, obstetrics-gynaecology or pathology.

In any of the more than two dozen specialised fields, the young doctor will need several years of residency training if he is to meet the standards for certification set by the university in each

speciality. These standards differ from one speciality to another; but generally they require at least three years of residency following internship, and may require as many as five. In surgery, for example, a longer residency is required than in general medicine.

The years served (4 years) in residency usually are consecutive—1st year, junior house surgeoncy; next 2 years, postgraduate study; and the last year, that is 4th year, to be spent in research under the guidance of the professor of cardiology.

For those seeking a career in investigative or academic medicine, this additional training can be especially valuable. In a growing number of medical teachiog centres, residents may take advantage of fellowships or traineeships, which provide support for additional training and research in a basic science or a clinical field. This of course is optional.

As the resident gains experience and proficiency in his specialised field, he also acquires more responsibility in the hospital. More reliance is placed on his judgement in matters of diagnosis and treatment. He helps to supervise and train interns, and if he serves in a hospital affiliated to a medical college, he will help teach medical students as well. Teaching others keeps the resident "on his toes," and naturally beneficial discussions result when students, interns, and residents make ward rounds together. His own learning, of course, is important, and in a residency training programme, worthy of the name, this is given priority over duties of patient care in the hospital.

TRAINING IN CARDIOLOGY

DR. K. I. VYTHILINGAM

TRAINING should be offered only in centres where there are facilities for cardiac and pulmonary diagnosis. The minimum requirements should be a pulmonary function laboratory, cardiac catheterisation laboratory, radiadiagnostic facilities and laboratory facilities for gas analysis. It would be well also to have cineradiography.

The minimum qualifications for trainees should be M.D. in general medicine or M.R.C.P. for postgraduate course in cardiology and M S. in general surgery or F R.C.S. for postgraduate course in cardiac surgery.

A good training in general medicine is absolutely necessary before the candidate goes in for specialisation in cardiology or cardiac surgery. It would be worth while to ask all those who plan to do specialisation in cardiology to have one year of registrarship in general medicine and in the case of cardiac surgery six months of registrarship in cardiology, if possible, before taking to the speciality.

A candidate for M.D. in cardiology should have five years of experience in general medicine with a postgraduate degree, either M.D. in general medicine or M.R C.P. with some good experience in cardiology for one year at least.

For surgery, one should have five years of experience in general surgery with a postgraduate degree, either M.S. in general surgery or F.R.C.S. with some experience in thoracic surgery for six months at least.

DURATION AND CONTENTS OF COURSE

Every candidate should work for at least two years in the Cardiology Unit which should be modern in every respect and another year in research work under the guidance of the professor on some clinical aspects of cardiology.

This one year should be considered as post-doctoral following, during which period he would gain experience in teaching and as a consultant.

The course should consist of every aspect of cardiology and to some extent limited to general medicine. Special attention should be paid to epidemiology of cardiovascular diseases, including embryology, physiology, pathology, radiology, clinical diagnosis, laboratory investigation and pre- and post-operative assessment of cardiac cases.

The study should include:

(1) History of cardiology.
(2) Embryology and applied anatomy of cardiovascular system.
(3) Physiology and applied physiology of cardio-pulmonary system.
(4) Haemodynamics and electrophysiology.
(5) Pharmacology of relevant drugs.

Special postgraduate lectures may be given to the candidates once a week besides seminars and discussions. These lectures should rotate among the senior persons in the different departments. Guest speakers may be invited.

TEACHING PATHOLOGY

Pathology includes pathologic anatomy, clinical pathology, bacteriology and immunology and blood bank. Trainees should be started in the post-mortem room where medical science began. Here they will not only see disease in the fresh state but will get a good review of cardiopulmonary anatomy with tissues much more life-coloured and pliable than in anatomy cadavers after prolonged storage. Three weeks on post-mortems, not merely as observer, but as glove-and-gown prosector, seeing and describing the gross surgical specimens, selecting pieces for microscopic study and writing up the microscopic descriptions, will sharpen a candidate's histologic and pathologic memory. All this, of course, should be done under close supervision of a senior pathologist.

After three weeks in general pathologic anatomy, the candidate may be allowed to concentrate on his special area—lungs, heart and vessels Here comes the value of the pathology museum. He can review a few dozen mounted specimens with their clinical records. But much more good will come if he can study a few hundred hearts and lungs from wet storage. The wet specimen can be manipulated and redissected if desired, in order to gain a thorough understanding of the lesion. There is no substitute for personal study of actual specimens.

At the same time, he may spend some time in bacteriology learning the technique and interpretation of blood cultures, throat and sputum cultures and smears. Some experience should be gained in the clinical laboratories also.

Wherever possible, combined with actually doing the work in each of the areas mentioned above should be the teaching of students. To round off the three months in pathology, we recommend the last few weeks in the blood bank. Most doctors have occasions to order blood transfusion, cardiac surgeons more frequently. Each candidate should learn the fundamentals of blood bank and their procedures. In addition, the candidates should attend all clinico-pathological meetings.

Teaching of basic sciences has been integrated in Item 2 under contents of the course.

THESIS OR DISSERTATION

As the candidate has already been exposed to the discipline of writing a thesis for the examination of M.D. in general medicine, this should not be compulsory.

If thesis can be made a pleasurable overflow from a happy experience, it is good. The discipline of collecting observation from experience and reading, properly digesting them, deciding what is worth recording and writing lucidly, is valuable. In other words dissertation is preferable. The thesis however should not dominate the two years and must not take the candidate away from real life.

A record of his experience: Yes.

A library summary: No.

METHODS OF ASSESSMENT

(1) Assessment

(1) Day-to-day work and general aptitude.
(2) Ability in the diagnostic, investigatory and therapeutic aspects of the subjects.
(3) Research ability or papers published.
(4) Teaching experience and proficiency.

(2) Examination

Theory Question Papers

The candidate has to submit his investigative work as presented in the published papers, accumulated data or a special thesis to the examiners.

If the above is found to be of a high standard by the examiners, the candidate shall be exempt from appearance at the theory examination, otherwise he will have to appear in the following subjects:

(1) Principles and practice of cardiology.
(2) Applied cardiology.
(3) Sub-speciality.
   (i) Special instrumentation, like vector cardiagraphy and phonocardiography.
   (ii) Haemodynamic study: cardiovascular haemodynamic study including cardiac catheter, dye dilution curves, cine angiography and monitoring in cardiac surgery.
   (iii) Experimental: animal experiments including heart-lung bypass technique.

Clinical Examination

The clinical examination should be in the form of an exhaustive discussion on the clinical findings of problem cases. The candidate should be at liberty to support his findings by doing or asking for specialised investigations. Such clinical examinations must at least last two days.

Practical

The Board of Examiners ask the candidate to show his efficiency and knowledge of the special equipment necessary for such work as cardiac catheterisation, vectorcardiography, phonocardiography and indicator dilution curves.

CARDIO-THORACIC SURGERY TRAINING

Training should only be offered in centres where there are facilities for pulmonary and cardiac diagnosis. The minimum requirements should be a pulmonary function laboratary, cardiac catheterisation laboratory and radiodiagnosis facilities. It would be well also to have cineradiography, hypothermia equipment, cardio-pulmonary bypass equipment and an experimental laboratory for teaching the uses and physiology of the specialised equipment.

Preferably, training should be offered only in institutions which have good departments of cardiology and pulmonary (medical chest) diseases. Trainees should have a postgraduate degree in general surgery, either M.S., F.R.C.S. or American Board of Surgery, before taking up the speciality of thoracic surgery. We would suggest that the candidate must have one of the above degrees and he should have had experience of at least five years after his M.B.,B.S. He should also be evaluated as to surgical skill: no matter how many degrees a person may have, if he does not possess good surgical skill, he should not he allowed to take up thoracic surgery.

The period of training should be two years, and I would highly recommend one additional year of fellowship to give the candidate added maturity. The two-year period of training could be divided as follows:

Months

1, 2 and 3 : Pre- and postoperative care, diagnosis and diagnostic procedures in thoracic surgery.

4, 5 and 6 : Experimental laboratory for learning mechanical and physiologic problems of hypothermia, bubble and disc oxygenator and cardiac and pulmonary surgical techniques.

7 to 12 (6 months) : Active pulmonary and oesophageal surgery service with progressive operative experience, and assisting and observing all cardiovascular surgery.

13 and 14 : Cardiology service for learning cardiography, diagnostic procedures, medical management.

15 to 21 (7 months) : Active cardiovascular service with progressive operative experience in cardiovascular surgery and closed cardiac surgery, assisting and observing open cardiac surgery.

22 and 23 : Elective.

24 : Study leave.

During the entire period, attendance in the outpatient clinics two days per week should be required. Cardiothoracic pathology and physiology teaching should be an integral part of the clinical experience relating directly to patient care and operating room findings and problems Special didactic sessions should he held weekly throughout the two-year period. Interest in investigative problems should be stimulated and preferably should be related to clinical problems encountered on the clinical service. The trainees should also be given experience in teaching undergraduates.

The year of fellowship should be a year in which the candidate who has recently passed M.S. Thoracic can gain maturity as a consultant, as a teacher, as an independent laboratory investigator, as a diagnostician and as a skilled surgeon. All of this should be under the

close scrutiny of the Professor but with a freer rein than during the training period. The Fellow should be on the open heart surgery team and be allowed to begin doing more straightforward open cardiac cases.

It is essential to any teaching problem that an adequate library is kept with up-to-date texts and journals available at all times to the staff and trainees. Also it is necessary that a monthly departmental conference be held and constructive criticism of all deaths on the service be made. All trainees should be assigned topics for writing clinical papers which will train them in literature review, chart analysis, medical journalism and personal discipline.

Throughout the training period a file should be kept on each trainee including copies of his diagnostic and operative reports, so that his training can be periodically reviewed by the Professor and by outside examiners at the time of the M.S. examination.

METHODS OF SELECTION AND REQUIREMENTS OF POST-GRADUATE STUDENTS IN CARDIOLOGY AND THORACIC SURGERY

DR. S. B. ROY

"There is no harm in specialization provided it is not done with a narrow view."

REQUIREMENTS

A candidate has to undergo training in general medicine or general surgery and obtain the MD or MS before he is accepted for specialised post-doctorate training in cardiology or thoracic surgery. A candidate with an MD degree in pediatrics may be eligible for training in cardiology if he wishes to specialise in pediatric cardiology. Also these candidates holding other postgraduate qualifications like Membership of a Royal College of Physicians or Fellowship of Royal College of Surgeons should be eligible for admission provided be had at least three years' training in general medicine or general surgery.

It is difficult to stipulate the exact requirements. Should a candidate who has succeeded in his MD or MS examination in more than one attempt be given preference over a candidate with honours marks in MBBS but who had to appear for a second time in postgraduate examination? Should a straight MD or MS, without any failure from some universities where the percentage of success is more than 80%, be treated on equal footing with one from another university where the percentage of success is only 10%? Furthermore, should MD with cardiology as speciality or M.S. with thoracic surgery as speciality be preferred to MD and MS in general medine and general surgery, respectively? What about the divergent standards involved in this requirement? How are we to measure it? These are matters of general policy decision and need mature thinking. Does it necessarily mean that any university with a large percentage of successes has a lower standard tban another university with a high percentage of failures? For a broad guidance I suggest that generally students with good academic careers with longer training periods should be given perference over others only to the extent of short-listing them for selection.

SELECTION

There is no foolproof method of selection. However, applications should be invited from all parts of the country and a preliminary screening should be done of their academic records and training periods. Three times the number of vacant seats should be short-listed for interview. The Institute should pay their rail fare and for their accommodation during this period of interview. The interview may be conducted in one of the following two ways:

Method I

Interview should be divided into three parts:

1. Written quiz.
2. Bed-side clinical examinatioo and viva voce.
3. Geoeral interview to evaluate the candidate's aptitude, motivatioo, humanity and other aspects.
4. Psychometric evaluation for aptitude test may be useful if facilities exist.

1. *Written Quiz*

A huodred multi-choice questions pertaining to the speciality including historical names associated with it should be given for general evaluation of the candidate's knowledge. The time should he limited to two hours. The idea of this multi-choice quiz is to find out how quickly a candidate thinks and how well rounded he is in the speciality. After all when a candidate is coming for pos-doctorate training he already has been exposed to the speciality as a part of general medicine or general surgery. It is not like a quiz for admission to MD in medicine or MD in general surgery where the candidate has had no specialised training in the subject.

2. *Clinical*

Rather than long and short cases, exhaustive clinical discussion should centre round five to six cases covering different aspects of the speciality. Coocurrently koowledge in basic sciences including pathology, therapeutics and techniques should be ascertained during the clinical examinatioo. A subsidiary viva voce should be held to detail the programme.

3. *A General Interview*

The general interview should be conducted by the senior staff members of the department with two or three staff members of collateral departments, for example, for cardiology, professors of thoracie surgery, physiology and of pathology should also be invited. If there is a clinical psychologist his help will be very useful.

4. *Evaluation of Marks*

A hundred marks should be given for the quiz, 200 marks for the general interview and 300 marks should be given for clinical examination.

Method II

POSTGRADUATE COURSE OF STUDIES IN CARDIOLOGY AND CARDIAC SURGERY: DURATION AND CONTENTS

DR. J. C. BANERJEA

IN view of the increasing need for trained personnel in the speciality of cardiology whose frontiers are expanding rapidly, it is desirable to institute a course of postgraduate studies in this speciality and set up as high a standard as is available in this country. The duration and contents of the course require careful consideration. A cardiologist must have a sound background of general medicine. The candidate aspiring for higher training in cardiology and subsequently for a teaching appointment in the subject should possess an M.D. degree in general medicine or an M.S. degree in general surgery.

Thereafter, he should prosecute, for a period of two years, a course of postgraduate studies including preparation of a thesis or dissertation with a critical review in any aspect or branch of cardiology. At the end of this period he should take an examination (theoretical, clinical, practical and oral) and if successful be should be awarded the Doctor's degree in cardiology or the Master's degree in cardiac surgery.

An outline of the course of studies is given below. The details may be filled in later by a Board of Postgraduate Studies in Cardiology. Teaching of the basic medical sciences should be an important part of the curriculum.

Studies in anatomy including developmental anatomy of the cardiovascular system and cardiovascular physiology specially in high altitudes, under hypothermia, experimental physiology, histology, biochemistry and biophysics should cover a period of at least six months.

Studies on the pathology of cardiovascular diseases, bacteriology, parasitology and virology in relation to diseases of the heart and vessels should continue for a period of three months.

Pharmacology and cardiac therapeutics should receive attention throughout the whole course of study.

The candidate should gain practical experience by actual participation in various modern investigative procedures such as cardiac catheterisation, recording of rapidly fluctuating arterial or ventricular pressures and pulmonary capillary pressure by various types of electronic transducers, estimation of cardiac output by the Fick principle, detection of cardiac shunts or obstruction of vascular channels, coronary sinus catherisation for estimation of the efficiency of the left ventricular myocardium, estimation of cardiac output by the dye dilution technique or stroke volume by Ballistocardiography.

Cardiac radiology, cine fluorography, angiocardiography, aortography, coronary arteriography, renal arteriography and electrokymography should also have their due share in the syallabus.

Electrocardiography (including use of intracardiac leads), vector cardiography, and phonocardiography (including internal phonocardiography) have to be studied intensively during the course.

The candidate shall be required to produce evidence of having carried out or actually participated in the above investigative procedures in at least twenty cases.

He should also acquaint himself with important laboratory tests, among others. such as estimation of ESR, C-reactive protein, SGOT, S-LD, SGP-T, estimation of prothrombin time and index, estimation of BMR, serum PBI, radioactive iodine uptake, serum cholesterol, lipoprotein and triglyceries, etc.

Didactic lectures on diseases of the heart and great vessels with special regard to epidemiology, aetiology, pathology. symptomatology, diagnosis, differential diagnosis, treatment (medical and surgical) and rehabilitation should not exceed eighty in number. Emphasis is to be laid more on lecture demonstrations, seminars and clinicopathological conferences which together may perferably cover 100 hours in 50 sessions of 2 hours each during the whole course.

Clinical instructions should be imparted on every working day for a period of two hours during the whole course.

The candidate for the Master's degree in cardiac surgery should, in addition, perform cardiovascular operation in animals and in human cadavers, and thereafter perform or actively participate in surgical operations in cardiac patients with constrictive pericarditis, acquired valve diseases such as mitral stenosis, aortic stenosis; congenital defects such as patent ductus arteriosus, coarctation of aorta, aortic and pulmonary stenosis. He should be thoroughly conversant with the technique of open heart surgery of arterial septal defect, ventricular septal defect, Fallot's tetrology under hypothermia or with the application of recently developed pump oxygenator.

He should submit a full record of twenty carefully reviewed cases of cardiac patients treated surgically by him or through his active participation including a follow-up and their rehabilitation, if any.

METHODS OF TRAINING IN CARDIOLCGY AND CARDIAC SURGERY

DR. N. GOPINATH

Professor of Thoracic Surgery, All-India Institute of Medical Sciences, New Delhi

THIS is the most opportune time to discuss this subject as we are on the threshold of initiating a programme. So far, there is no unit to my knowledge, with a comprehensive training programme in this field, in this country. A full-fledged training programme in thoracic surgery has been introduced by the University of Madras, and Christian Medical College, Vellore, has pioneered in this field.

It is advisable to have a single well integrated unit where training in Cardiology and Cardiac Surgery could be given The training in these two fields is complementary as similar problems are present in the total care of the patients. Medical knowledge in this field has progressed so much that the rigid boundaries between cardiology and cardiac surgery have disappeared. The cardiac surgeon ought to be well versed in clinical and hemodynamic evaluation of cardiac cases

Training in cardiac surgery is an advanced programme and ought to be a continuous process lasting one's whole professional career. Moreover, one should not lose sight of the fact that the candidate has had adequate training in general surgery and thoracic surgery. The training he receives in cardiac surgery is to give him a base to work on. If one appreciates these two factors, then problems are easier to tackle. We must be aware of the fact that there are very few centres in India, at present, where advanced cardiac surgery is being done. Otherwise one has to consider training programmes where only closed cardiac surgery can be taught and the candidate has to move into another where he can learn open heart surgery. This is a phased programme, though advantageous from trainees' point of view, not wholly acceptable as the candidate spends a longer time in overall training. He may have to go over the training again, partly at least. This does not mean that we should not consider this aspect, as in our country there is a large number of surgeons present who need this phased programme of training.

It should be our aim to expose him to all the branches of this specialty. If he wants to fully occupy in any of the subspecialities later, he would be able to follow his natural inclination. Moreover, it should not be said that he should complete all his research work during the training programme. He could do only a preliminary part which by itself could be a short research programme. He could return to his parent unit to continue, at a later stage, his work.

Let us briefly consider what the unit ought to be. It should be part of a teaching hospital with a sufficient number of beds, preferably fifty. Cardiology and cardiac surgery departments must be fully integrated. This is necessary not only from the working point of view but also

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Since study of vectorcardiography, phonocardiography and ballistocardiography form part of advanced cardiological training, a reasonable period of six months must be spent in this field. The candidate is required to submit a short paper on any problem in this field.

We must also give thought to exploring a few possibilities of interchange of trainees. If this is not possible, at least the trainees should be given an opportunity of visiting other units in the country. A few scholarships to help this programme would pay rich dividends and enable students to exchange views. I think distinguished surgeons and cardiologists from abroad, who are willing to stay for a few weeks in the unit, should be invited which would be an additional stimulus to the students. In this way, more candidates are brought into close contact with recent trends in these subjects, not to speak of other advantages that accrue in the form of opportunities for the trainees to go abroad, critical evaluation of their work and a spirit of challenge.

These trainees after they have established themselves in a year or so may be given fellowships for going abroad either to pursue a further research programme or to visit medical centres. One cannot expect to have an active cardiac unit and also run a training programme on a shoestring basis. Therefore adequate financial help must be made available and fellowship must be provided to mitigate the hardship and attract fellows to choose this career.

With a training programme indicated above, we come close to the dream of Evarts Graham 'to do major surgery, to engage in research work and to have a clinic of younger men who would be interested in studying and developing ideas.'

room, the trainee should be given progressive responsibility and opportunities so that by the time he finishes half the period of training he can do independent closed heart surgery and continue to participate in open heart surgery.

A candidate has to work in the research and animal laboratory either whole-time or concurrently. He ought to complete a research programme. This would help him in finding out whether his interest lies in research. If he has the potentialities, then it is worth considering whether he can continue in this line later. He can do so either in this laboratory or elsewhere, even abroad. If research does not appeal to him, at least he will appreciate the problems presented before him and would be able to scrutinise literature with a critical eye (John Gibbon).

Surgical laboratories open up avenues for learning techniques of surgery and use of special insruments As for training related to open heart surgery, he can learn the techniques in the laboratory, and help to run the heart-lung machine in the operating room and interpret the biochemical data needed.

All this is based on the assumption that the cardiac surgeon has adequate knowledge of cardiology. He should gain sufficient experience in interpreting hemodynamic, biochemical and fluid balance data. When this training is completed, he will be a fairly accomplished surgeon, teacher and investigator. With the set-up enunciated above the number of trainees acceptable would be two per year.

What about the training of cardiologists?

Prof. Sujoy B. Roy refers to a post-doctoral training programme in this speciality and the report gives an account of how it is being practised in this Institute. It includes a short-term training for four to six months given to physicians primarily interested in cardiology in specialised techniques of investigation. Of particular interest is the training provided in advanced cardiology given for a minimum period of two years leading to a post-doctoral degree with the aim of producing teachers and research investigators. Training is given in clinical cardiology. Attending the cardiac clinics including pediatric groups, ward rounds, patient care in ward and acting as consultants to other units in the hospital, all these give adequate experience. Other programmes include weekly case study conferences, combined cardiac conference, undergraduate teaching and weekly journal clubs.

Besides these, as aforesaid, much of the present-day cardiology includes active care of patients, who are potential surgical cases, and as such six months of their period are required to be spent along with the surgical team. Working knowledge of basic principles of hypothermia and extra-corporeal circulation should be acquired. Other responsibilities include active participation in the monitoring and post-operative care of patients after open heart surgery. Concurrently the candidate can work in the cardiovascular laboratory on an assigned project.

Since hemodynamic study of cases forms an important part, the candidates should spend one year in this field. This includes learning of the technique of cardiac catheterisation, analysis, interpretation and evaluation of data, indicator dye dilution technique, phonocardigraphy and intracardiac electrocardiography. It is expected of candidates to have a fair idea of techniques. They should also know how to interpret data.

Teaching of Biochemistry: Biochemistry is assuming an increasing role in medical research. Handler says, "Biochemistry has become the very language of modern biology." They should be *taught the applied aspects of this subject. The subject should include:*

1. Blood gases analysis—Oxygen—Carbon dioxide.
2. pH of blood.
3. Enzyme estimation—SGOT.—SGPt. — Lactic acid Dehydrogenase. — Malic Dehydrogenase.

These are particularly important for establishing the diagnosis, prognosis and progress of cardiac cases.

4. Electrolyte studies including Sodium, Potassium, Calcium and Magnesium.
5. Estimation of fatty acids both saturated and unsaturated, Cholestrol and Phospholipids, is essential to explain their role in certain diseases in cardiology.
6. Electrophoretic study.

Teaching of Biophysics: Many recent cardiological tools have been the gift of physics. Hence a good knowledge of biophysics is extremely essential for planning the future research programmes and for the proper understanding and correct interpretation of electrical radiological, ballistic, phonological, rheological, kinetological and pressure studies in relation to heart and blood vessels. The teaching should embrace didactic lectures and demonstration on experimental animals.

1. Electrocardiography: In electrocardiography they should be taught the normal and abnormal limits of tracings and the limitations of electrocardiography.
2. Vectorcardiography.
3. Ballistocardiography.
4. Rheocardiology.
5. Radiology. i. Fluoroscopy; ii. Orthoradiography; iii. Teleradiography; iv. Electrokymography with teleradiography; v. Tomography; vi. Angiography; vii. Retrograde aortography.
6. Phonography; Phonocardiography.
7. Pressure studies; Jugular phlebograms, Arteriogram.
8. Cardiac catheterisation.
9. Respiratory ventillatory function studies.
10. Circulation time.
11. Dye dilution curve to study cardiac output.
12. *Radio-active Isotope studies.*

TEACHING OF PATHOLOGY AND BASIC SCIENCES IN THE CURRICULUM OF CARDIOLOGY

DR. K. N. GOUR

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WITHOUT the applied knowledge of basic sciences, it is not possible to appreciate the disease process in the study of cardiology. Stress should be laid on the teaching of basic sciences like anatomy, physiology, biochemistry, biophysics, biostatistics, microbiology and pathology which are the pillars on which the edifice of clinical medicine stands.

Period of Training: The postgraduate training and teaching in cardiology should extend over a period of two years after they have graduated in general medicine. Six months out of the two years should be devoted to the basic sciences mentioned above. During these six months a student should also be attending the cardiology department every morning and clinical cardiology under a postgraduate teacher.

Teaching of Anatomy: While teaching anatomy the postgraduate student should be shown dissection, museum specimens and models. Some twelve didactic lectures must be given on the applied aspects of cardiovascular system.

Teaching of Physiology and Biochemistry: Stress should be laid on the applied aspects. They should be told how the normal physiological and biochemical processes have been impaired resulting in abnormal physiology and abnormal biochemistry. Stress should also be laid on experimental physiology.

In cardiology they should be taught the following subjects:

1. Properties of heart muscle, nutrition and metabolism.
2. Cardiac cycle and nervous regulation of heart and circulation.
3. Cardiac output. The mechanical efficiency of heart in relation to the cardiac output.
4. The carbohydrate metabolism of heart muscle and its peculiarities.
5. Heart rate and its regulation.
6. Oxygen requirement.
7. Relation between oxygen consumption and work of the heart.
8. Coronary circulation.
9. Pressure and volume changes.
10. Blood pressure.
11. Arterial pulse.
12. Venous pulse.
13. Heart-lung preparation.

METHODS OF ASSESSMENT (CARDIOLOGY AND CARDIAC SURGERY)

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THE assessment of a postgraduate in cardiology and cardiac surgery must provide to the medical profession, to the lay public and to the administration a means of discriminating between those who are thoroughly qualified to be accepted as teachers, consultants and investigators in these specialities and those who are not. A combination of examination, opinion of the chief concerning his professional ability and training in a well-equipped hospital under a senior consultant for a specific period should be the hallmark of scholarship and academic distinction.

An approved residency training in cardiology should include assignment to basic sciences, provided this is an integral part of the programme of clinical cardiology including electrocardiography and roentgenography, haemodynamics including cardiac catheterisation, dye dilution studies and cine-angiocardiography, special investigative tools like vectorcardiography, phono-cardiography, ballistocardiography, etc. and experimental cardiology and involvement in a research project. A postgraduate in cardiology should familiarise himself with principles of cardiac surgery during his training period. Major operative experience should be an additional essential part of training in cardiac surgery. The most important single factor in the development of a cardiologist and cardiac surgeon is the opportunity under guidance and supervision to grow by progressive and succeeding stages to the stature of complete responsibility for the care of the patient.

The evaluation of such a training programme must precede any permission to appear for the examination. The candidate may be required to submit a record of cases including a variety of material with complete investigations carried out personally, follow-up, and concluding with a critical analysis at the end of each report. A candidate in cardiac surgery may be required to submit a list of operative procedures performed by him during his training period and the preceptor be required to vouch for the candidates' integrity, surgical judgment and technical skill.

Clinicopathological conferences should be frequently held. The aim should be to guide and stimulate the postgraduate students so that they may work largely by themselves as far as their values and testing of conclusions are concerned.

TEACHING OF PATHOLOGY AND BASIC SCIENCES IN THE CURRICULUM OF CARDIAC SURGERY

Whatever has been written in the preceding pages in connection with cardiology applies with equal force to the teaching of those subjects in cardiac surgery. But on account of certain reasons it is desirable to denote something more in relation to cardiac surgery.

We all know that cardiac surgery has been making rapid strides in the past few years so *much so that the old saying of Kocher,* "*the Surgeon who touched the heart should lose the* respect of his colleagues," has entirely changed. Now the heart is opened, the defect is corrected and the heart *sutured.*

But the surgery of the cardiovascular system demands a very sound knowledge of human physiology and biochemistry and pathology than ever before, for developing a sound judgement and surgical technique, both in congenital and acquired cardiovascular diseases.

The technic of surgery should be practised on animals. The technic should provide a valuable method for fundamental research. For extensive surgical procedures it is necessary that there should be available certain information, e.g., about the exchange of gases in the lungs and tissues and the maintenance of a constant chemical and physical structure of the blood and body fluids as the technique of surgery should be to restore the organ to its normal functions.

The teaching should be also directed to the various anaesthetic precedures, pump oxygen generator machines for extra corporeal circulation and the use of hypothermia in cardiac surgery.

REPORT OF THE SUB-COMMITTEE ON CARDIOLOGY AND CARDIAC SURGERY

DR. K. I. VYTHILINGAM

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DR. S B. ROY

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IN view of the increasing need for trained personnel in the speciality of cardiology, whose frontiers are expanding rapidly, it is desirable to institute courses of postgraduate studies in this speciality and to aim at a high standard of teaching. The duration and contents of the course require a careful consideration. The cardiologist must have a sound background of general medicine.

Aim

To train specialists in cardiology and cardiac surgery to enable them to be teachers, investigators, and consultants.

Pre-requisite for giving postgraduate training

It is envisaged that in the next five years the country will need 125 to 150 cardiologists and 70 to 80 cardio-thoracic surgeons.

1. *Institute Requirements*

Fifty in-patient beds of which 20 per cent should be pediatric and 30 per cent female. Remaining being male beds.

Cardiac clinics which should see 500 new cardiac cases every year with adequate follow-up facilities.

2. *Requirements*

1 Haemodynamic and associate cardio-vascular laboratories.
2 Biochemical laboratories.
3 Experimental laboratories.

3. *Personnel*

1	Professor/Director	... 1
2	Associate Professors	... 2
3	Assistant Professors	... 4
4	Research Officers/Registrars	... 4
5	*Technicians*	
5 : 1	Senior Technicians	... 2

general qualifications as a specialist in cardiology and cardiac surgery. There may be clinical practical, oral and written examinations.

Written examination should be of the objective type and must be designed to test the candidate's knowledge of the sciences relevant to cardiology or cardiac surgery, general cardiology problems and recent advances. One of the papers may be of multiple choice type, and another of the usual essay type.

Clinical examination in cardiology is meant to test the clinical maturity of the candidate in addition to testing factual knowledge at the bedside of the patient. A number of patients posing specific problems should be taken up with the candidate for discussion. At least one long case should be thoroughly investigated by the candidate himself. In the case of cardiac surgery it would be desirable if the candidate is made to perform an operation in the presence of examiners.

During the practical examination the candidate should be left with a number of electrocardiograms, X-rays, other tracings, and haemodynamic data to interpret. Oral examination should be a kind of informal chat.

responsibility of patient care; participation in research programme and in animal laboratory including service in cardiology for 3 months. Total duration—24 months.

A candidate should be able to do all types of surgery independently before his term is over.

7. *Methods of Training*

Methods of training should be based more on the form of team work rather than didactic teaching. The broad principle in training should be participation in patient care, conference, journal clubs, undergraduate teaching, seminars and case conferences and panel discussions.

8. *Methods of Assessment and Examination*

As the candidate has already submitted a thesis for M.D., or M.S., in general medicine or surgery, he should be exempted from presenting a thesis for the post-doctoral degree. The exemption from training should be based on day-to-day basis and only those candidates who satisfy the preceptor should be allowed to take the examination.

Examination: The Board of Examiners should consist of the Professor of Cardiology as the internal examiner and two eminent doctors in the field of cardiology as external examiners.

Theory Papers: There should be one paper in theory to test the knowledge of the candidate in the applied aspect of cardiology including cardiovascular physiology.

Clinical examination should be exhaustive, where the candidate should be asked to demonstrate his clinical ability in three or four patients with cardiac problems. The candidate will be at liberty to support his findings by doing or asking for specialised investigations. Such clinical examination must last two days.

Practical: The Board of Examiners may ask the candidate to show his efficiency and knowledge of the special equipment necessary for doing such work as cardiac catheterisation, vectocardiography, indicator dilution curves, etc.

Oral Examination: The oral examination should be searching and every effort must be made to examine the candidate in the various sub-specialities in cardiology. It is suggested that each candidate's oral examination should last one to two hours.

Cardiac surgery: There should be one paper in theory, on surgical problems, pathophysiology, transplantation of tissues applicable to cardiovascular lesions. The paper may be in the form of essay.

Importance should be attached to clinical and *viva-voce* examinations. These should be exhaustive. These should include clinical examination of 3–4 cases, discussion on ward cases and on operating session. *Viva voce* is to be in the form of discussions mostly.

The list of operations done by the candidate, work done in the laboratory, and articles published must be taken into consideration.

(One to be in charge of haemodynamic laboratories and one for the heart-lung machine).

5 : 2	*Technicians* including three for Electrocardiogram	...	6
5 : 3	Laboratory Assistants	...	4
5 : 4	Electronic Technician	...	1
6	Biochemist	...	1
7	Record Librarian	...	1
8	Stenographers	...	2
9	Store Clerk	...	1

4. *Note*

The above is the rough requirement for combined laboratories of cardiology and cardiac surgery. The professionals required for cardiac surgery will be as follows:

1	Professor/Director	...	1
2	Associate Professor	...	1
3	Assistant Professors	...	2
4	Research Officer/Registrars	...	2

5. *Methods of Selection and Requirements*

Requirement: A candidate has to be an M.D. in general medicine or M.D. in pediatrics, or an M.S. in general surgery to be eligible for acceptance in post-doctoral training in cardiology or cardiac surgery. Those having higher qualifications like Membership of the Royal College of Physicians or Fellowship of the Royal College of Surgeons are also eligible provided they had three years of training in general medicine or general surgery.

Selection: Two to three times the number of vacant seats should be invited for interview. The candidates sponsored by the States, Defence Services or other international agencies should be selected. The method for selection either on day-to-day observation basis lasting a week or so or by methods of general interview including written and clinical examinations may be employed.

6. *Duration and Contents of Course*

Duration of the course should be for a minimum period of two years during which time all aspects of cardiology including embryology, physiology, pathology, radiology, special instrumentation and pre and post-operative assessment of cardiac cases should be undertaken.

Roughly the course should consist of the following:

Clinical cardiology including radiology, electrocardiography for 24 months.

Haemodynamic and allied studies for one year.

Cardiac surgery and cardiovascular experimental laboratory for six months.

Special instrumentation like vector cardiogram, ballistocardiogram, phonocardiogram for a period of six months.

Cardiac surgery training is essentially based on participation in all activities of the unit. Progressive responsibility in surgery including open heart surgery; in-service training with

CONTENTS OF COURSE AND METHODS OF TRAINING

There should be a period of preliminary training for three months in the fundamental principles and basic techniques of plastic surgery. Aptitude and suitability for advanced training should be carefully assessed during this period. Unsuitable candidates should leave the course at the end of this period.

Trainees should work as full-time assistants in the unit, and private practice should not be permitted during the period of training. There should be a regular rotation of resident and emergency duties for all trainees. In the day-to-day work of the unit, as they prove their competence, they should be given increasing responsibilities to plan and carry out the treatment of patients. They should maintain a work diary, in which should be entered recorded comments and notes on all the cases in the treatment of which they have had some share.

The training programme should also include the following:

1. A course of lectures covering the whole scope of plastic surgery.
2. Seminars in which trainees take the active part.
3. Review of literature, during which every trainee presents abstracts and critical reviews of important publications.
4. Case discussions and treatment of planning sessions, in which trainees apply their minds intensively to the study of selected cases, presenting their analyses of problems, objectives of treatment and detailed plans of treatment.
5. General course of instruction, mainly practical, in fields closely related to plastic surgical work: anaesthesia; surgical care of infants; dental work in plastic and maxillofacial surgery; physiotherapy, occupational therapy, speech therapy, and rehabilitation in general; clinical photography and modern methods of medical illustration and documentation; methods and tools of clinical research.

TEACHING OF PATHOLOGY AND BASIC SCIENCES

Throughout the period of training postgraduates are encouraged to visit basic sciences departments, to gain fresh knowledge of anatomy, physiology and pathology related to their research or clinical work in the plastic surgery unit.

A series of extension lectures or seminars on basic themes should be organised for postgraduates and the staff on all clinical departments in the institution with emphasis on integration of basic and clinical aspects.

METHODS OF ASSESSMENT

Training in plastic surgery is adequate when the candidate has attained a level which enables him to:

1. analyse complex plastic surgical problems into their basic elements; find effective solutions for each; define objectives and priorities in treatment and make a safe working plan best suited to the needs of the patient, and to carry the plan through successfully without danger to the patient;

TRAINING IN PLASTIC SURGERY

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IT is necessary to have a degree in plastic surgery to indicate adequate training and competence to practise this speciality. The degree in plastic surgery requires a higher level of training and takes two years longer to complete than the present M.S. degree in general surgery. It should therefore be considered clearly as a qualification one level higher than the present M.S.

NOMENCLATURE

The degree in plastic surgery may be called M. Ch. (Plastic).

SELECTION OF POSTGRADUATE STUDENTS

It is essential to select bright candidates who have already reached a basic level of general training and experience in the broad field of surgery, so that special training in plastic surgery can be completed in two years. The candidates should have worked in a good surgical environment for some years, following one year of resident house-surgeoncy, after getting the M.B.B.S. degree. They should have also given tangible proof of having reached the required basic level. The following criteria may be kept in mind while selecting students for plastic surgery.

1. M.S. or equivalent qualification in general surgery, orthopaedics, or otorhinolaryngology;
2. a recognised surgical specialist in the Army Medical Corps;
3. qualifying examination in basic sciences and essentials of surgery, after a course of training for one year in general surgical units, and one year in special surgical units, with concurrent training in the basic sciences departments. The course should be taken after the candidate has completed one year as resident house surgeon.
4. a graded surgeon for two years in the Army Medical Corps;
5. experience of a resident post in plastic surgery training unit for two years, which is of use for advanced training in plastic surgery. This criterion is applicable only if such a candidate has been unable to satisfy criteria (1) or (3) due to the exigencies of his posting in the plastic surgery unit. No part of one year's house surgeoncy will be counted for this purpose as resident post.

DURATION OF COURSE

Selected candidates can be trained for M. Ch. (Plastic) degree in two years.

2. observe and evaluate his results objectively, find deficiencies, trace imperfections in planning and techniques, and improve on these.

Adequate training brings the candidate to the 'take-off' stage when as a junior specialist he is able to correct himself and to continue his training without guidance from a teacher.

The basic principle in the method of assessment is to test whether the candidate has reached this take-off stage, and whether he has sufficient judgement to be a safe specialist.

Credit is therefore to be given for (1) original ideas, (2) exact knowledge of all important facts, (3) scientific reasoning, (4) clarity and force of presentation of ideas, (5) good memory for details.

Debits should be scored for (1) wrong fundamentals, (2) omission of important facts, (3) evasion of crucial points, (4) failure to correct absurdities and contradictions, (5) irrelevant padding in the presentation of ideas.

M.Ch. (Plastic) examination. In it is expected of the students to unite a thesis or dissertation on a particular subject. It should be submitted three months before the examination, and should be approved by all the examiners before the candidate can sit for the examination.

A certified Record of Work maintained by the candidate during his training should be made available to the examiners during the clinical and oral examinations for evaluation. The candidate should have carried out a fair variety of major plastic work on at least twenty cases, independently, before taking the examination.

The Written Test should consist of three papers: (I) plastic surgery, general; (II) plastic surgery, regional; and (III) fields closely allied to plastic surgery.

Clinical examination should consist of one long case and several short cases to test in detail the candidate's ability to assess cases, to plan treatment, and to carry out major operative procedures safely, as a junior specialist in plastic surgery, working without guidance.

Oral examination should finally assess the candidate's shortcomings and special merits.

There should be at least three examiners, and the candidate should be declared successful only if all the examiners agree.

Using the many methods for instruction at the postgraduate level, the course contents will be covered over a period of two years in six phases, some running concurrently, others in sequence.

1. *Patient Care:* This forms the most important method of teaching. The candidate will be allotted a certain number of beds in the in-patient area and he will be solely responsible for patients on these beds for pre-operative work-up, which will include complete case study, together with carrying out investigatory procedures and arriving at a difinite diagnosis. Besides, if operations are indicated for these patients he will prepare them for the same and will be responsible for the care of the patient during the post-operative period. During this period he will be under the constant guidance of a senior urologist.

Out-patient work, which complements the in-patient activities, will be another area where he will be exposed to urological problems, and where he will do a complete work-up of the case, and present the case to the senior urologist in attendance during the out-patient sessions.

2. *Didactic Teaching:* Formal lectures to cover topics related to the genito-urinary tract and others related to basic sciences which are required for the understanding and the proper appreciation of genito-urinary tract diseases must be planned, and the schedule drawn up for a period of at least three months at a time, so that the candidate will have an opportunity of reading through the material in advance. In the presentation of these formal lectures by the senior staff of the Medical College, attempts must be made, wherever possible, to include local case statistics. The faculty's experiences and the knowledge of the local conditions should be shared with the candidates.

3. *Group Studies:* The present trend in postgraduate instructional methods is to have all the candidates grouped together for certain activities, where ample opportunities are provided for them to participate in the discussion. The procedures advocated are:

(a) In a seminar type of presentation of topics where a number of disciplines have to contribute, the faculty of each discipline will be brought together with the candidates and the topic discussed in detail. One of the trainees must be expected at this seminar to take a major role in the presentation of the topic.

(b) *Literature Review (Journal Club):* From well chosen journals, relating to urology, a few should be assigned to each candidate, and every week each candidate will report to the group, in the form of a summary, the articles he has read in the journals he has been asked to read.

(c) *X-ray Review Session:* All X-ray examinations done during the week will be reviewed by the candidates and the staff of the Urology Unit with the help of a senior radiologist.

pathology he finds when he opens an abdomen. Closure of vesico-colic fistula, enlargement of the capacity of 'thimble' bladder, transplantation of ureters, and many other urological procedures require an intimate knowledge of techniques in intestinal surgery.

COURSE DURATION

While no time limit can be put for attaining perfection, at least two years and preferably three are needed to train a genito-urinary surgeon. Why does it take two years or more to accomplish this? All individuals do not learn at the same pace. The range and volume of clinical material is such that it cannot ordinarily be covered in less than two years. The acquisition of the ability to make decisions and the development of clinical judgement take time.

In genito-urinary surgery, a field in which more accurate diagnosis is possible than in any other branch of surgery, the use of delicate and expensive diagnostic instruments like endoscopes and interpretation of what is observed requires an adequate period of supervision. Instrumentation is the 'bedrock of urology' and developing a gentleness of hand in using instruments needs constant guided practice Endoscopic surgical techniques are unique in the sense that the teacher can give only a limited supervision, because one cannot often see what the other is doing unlike in open surgical procedures. Thus an added period of one more year seems very necessary after the candidate develops confidence in endoscopic diagnosis.

Recent advances in the understanding of the basic sciences related to the genito-urinary tract have widened the scope and indications for conservative and reconstructive surgery of the urinary tract. The critical understanding of these basic sciences requires extensive review of the literature by the trainee.

The trainee must be familiar with gynaecological urology. To achieve this a short period of his study must be in the gynaecology department. To understand problems connected with the neurogenic bladder, particularly in paraplegia, be may be given an opportunity, if feasible, to work in a neurological unit for a few weeks.

Pediatric and geriatric genito-urinary diseases occupy an important place in urological practice and to understand the associated problems at these two extremes of age requires an all-embracing approach. To this end the genito-urinary surgeon needs to be a physician as well. To attain this purpose and for the trainee to get an intimate knowledge of what may be called 'medical urology,' i.e. artificial dialysis, metabolic renal disorders, endocrine problems related to the testis and adrenals, etc. he must spend some time with a physician. Thus it is clear that for the training programme to be a comprehensive one the course duration cannot be less than two years.

COURSE CONTENTS

The programme planned for the trainee should primarily be of the in-service type. It is desirable to have the trainee as a staff member of the genito-urinary surgical team during the training period, and a proper designation should be given to him, so that appropriate responsibility for work can be assigned to him. Of the twenty-four months, twenty months must be spent in the main unit and the remaining four months divided between the related specialities like medicine (medical urology, endocrinology and neurology), gynaecology (gynaecological urology), and neurology.

4. *Practical Training:* Initially under supervision, this shall include:

(a) Diagnostic endoscopic work and other special investigations like cysto-urethrograms, differential renal function studies, air insuflation tests, etc.

(b) The operative programme shall include assistance during operations, and later, performance of major procedures with full responsibilities, the senior surgeon being in consultation.

(c) Minor endoscopic surgical procedures like fulguration of bladder tumours, bladder biopsies, etc.

(d) Major endoscopic resections if the candidate stays on for a year more, after his degree examination is over.

5. *Research:* (a) Retrospective study on case records initiated right from the beginning is essential, and the candidate must be given full opportunity for proper exploration of this material and reporting the findings in the form of papers submitted for publication.

(b) Well designed, prospective study with the help of a statistician is expected to be carried on by each candidate during the two-year period.

(c) A study of basic problems, by animal experimentation, bio-chemical or bacteriological investigations, should be encouraged.

6. *Exchange Programme:* The advantage of exchange programmes which are becoming popular at present cannot be underestimated. Arrangements must be made for the candidate to visit a well established genito-urinary centre in the country for a period of up to eight weeks during the second year of his study. It helps the candidate to exchange ideas with those who are under training in other centres, and it is felt that the candidate will benefit considerably from this exchange.

Apart from these activities in his own unit, a trainee should be encouraged to make use of every opportunity to take part in the academic activities of the institution as a whole, like refresher courses, clinico-pathological meetings and general pathology conferences. He may be given at least one opportunity of taking part in a surgical conference at the all-India level.

It is our opinion that an in-service programme with delegation of full responsibilities during the later part of the course, and a designation like Registrar, goes a long way in making up for any shortcomings, which cannot always be avoided, in any postgraduate course. The last three months in the training period must be entirely the candidate's own, when he can give finishing touches to his dissertations and begin on a plan of undisturbed study for the degree examination in the speciality.

Medical urology, including related endocrinology, must be included in the training programme.

Gynaecological urology should be studied and the candidate must attend gynaecological clinics and operations for short periods.

The candidate should be made to take an active part in all the activities in the department, including seminars, clinical demonstrations and teaching duties.

It may be stated as a fundamental consideration that in a specialist's department mere routine clinical work is not enough. There should be an active research programme conducted by the staff and brought to the notice of the postgraduates so that from the very beginning of the postgraduate course they might develop a flair for research activities. It is good to train the postgraduate to undertake some problems of research while in training and so to make him at the end of that period a person qualified, not merely to undertake diagnosis and treatment of the conditions, but fundamentally to be a research worker in association with his other duties.

The young urologist should use his spare time to see the practice of his surgical colleagues and to get up-to-date knowledge.

It may be necessary for him to spend, during this three-year period of training, a short period in another urological centre, so that he gets fully equipped with knowledge of the practice in other centres.

I shall like to end by quoting the words of a famous urologist, Hugh Cabot, "Let us work for the advance of our art, that our hearts shall be cleared with realisation that these better equipped men, who come after, as well reap the fruit of our labours."

Vesalius and Morgagni began, in the autopsy room. Here the student can see and discuss at first hand, and with a little extra use of time he can do some dissection of fresh tissues which are more life-like than cadavers in anatomy. Regardless of the cause of death, he can learn much of pathology and anatomy by performing, under guidance, his share of autopsies.

Alternating weeks should be spent on biopsy examination. To see the fresh surgical specimens, to cut them, and to select pieces for micro study, and then to describe the gross and the micro slides and check the findings with a senior pathologist, is an invaluable experience. Six weeks spent on the study of general biopsy and autopsy pathology will teach both pathology and histology, and provide a solid foundation for more specialised work.

The next two weeks might well be spent on urologic pathology, including male genital system. Study of a few dozen well-mounted museum specimens with the clinical histories will be beneficial. But much more valuable is to see several hundred preserved wet specimens of urologic interest, which can be cut and dissected and observed from all angles. If the organs in an active pathology department are stored in jars and properly indexed, they should be a goldmine to the students. This we know by experience at Vellore, especially when correlated with the micro slides, X-rays, histories, etc.

Since one cannot afford to breathe formalin all day, this is a good time to study exfoliative cytology and gram and acid-fast staining technique for a couple of hours daily. Every urologist should be able to perform these techniques himself—indeed at some places he may be required to do these. While cytologic search for tumor cells in urine has never been very rewarding, an acquaintence with the methods and the diagnostic criteria of the tumor cytologist is valuable.

The remaining four weeks of the pathology posting should be devoted to clinical pathology. The student should study a few hundreds of urine sediments microscopically and analyse the specimens for finding protein and sugar. He should learn how flame photometry for serum sodium and potassium is done, how to do a carbondioxide combining power and plasma chlorides. Why these four? Because they are the basis of testing electrolyte and acid-base balance which are crucial factors in case of kidney diseases.

A week in diagnostic bacteriology, not to become a bacteriologist, but to at least observe staining methods, cultures, antibiotic sensitivity methods, TB cultures, etc. will be very helpful.

A week in the urinalysis room, a week in clinical biochemistry, a week in bacteriology, and finally a week in the Blood Bank should be very helpful.

Does this mean too much of pathology? Considering the large part that tissue diagnosis and clinical laboratory procedures play in diagnosis and management of genito-urinary disease, I believe it is not at all disproportionate.

A most useful postgraduate teaching device, we have found, is the "visiting group." The various medical and surgical firms—chiefs, younger members, and postgraduates, often with undergraduate students—visit the pathology department at a stated hour each week or two, to see the more interesting biopsy slides from their patients. A pathologist projects the slides and all those who are present must participate in the discussion.

At the departmental conference at Vellore the first hour each day (8-9 A.M.) is devoted to reviewing of literature, gross specimen demonstrations, micro demonstration of biopsies, and

brain specimen cutting. Members of the pathology department should take an active part in these meetings and in the postgraduate lectures of the hospital in general.

Should the postgraduate be required to write a thesis or dissertation?

I feel if the student is asked to write a thesis then his practical work suffers. To neglect this side of his education is to impair his efficiency as a doctor. However, the discipline of observing accurately, collecting data, reading widely and well, and preparing a lucid report is very beneficial. Hence there should be a compromise. The subject matter of the thesis may be based on the student's actual hospital experience, in which case the writing of a thesis could not detract seriously from his attention to daily duties.

To summarise the pathology posting:

Weeks 1, 3, 5, Autopsies.
Weeks 2, 4, 6, Biopsies, general.
Weeks 7, 8, Preserved specimen study plus Cytology.
Weeks 10, 11, 12, Clinical Pathology. (Urinalysis, Clinical Bio-Chemistry, Simple Bacteriology, and Blood Bank).

5. *have passed an examination in basic sciences and principles of surgery, essential for the* candidate to be eligible for training in this speciality;

6. alternately have passed the M.S. in general surgery, orthopaedics or E. N. T. or the Fellowship of one of the Royal Colleges of Surgeons in the U. K.

In addition a candidate who has been selected for training in plastic surgery must spend a further period of two continuous years of training in a recognised plastic surgery unit under an approved teacher.

It is to be noted that a candidate who has served in the Armed Forces and has been recognised as a graded specialist in general surgery, orthopaedics or E. N. T. is exempted from clauses 2 and 3.

DURATION OF TRAINING

Two Years.

CONTENT OF TRAINING

The first three months will be devoted to preliminary training in basic plastic surgical techniques and their common applications in general surgical practice. Aptitude will be observed during this period, and there will be a test at the end of the period. Candidates who do well during this preliminary training will be selected for advanced training which will last the next 21 months. Candidates not retained for the full course will benefit from their preliminary training to the extent of being able to do simple plastic surgical procedures useful in general surgical practice.

Training will be largely practical, including sessions on diagnosis, treatment, planning and demonstrations of operation techniques, in addition to the usual lectures and seminars. Tests will be given on clinical judgement and operative skill from time to time.

The trainee will work as a full-time assistant in the training centre. He will be given increasing responsibilities for the actual treatment of cases depending on his competence. He will maintain a Case Diary and submit detailed records of all those cases he himself had treated.

Training over, candidates whose record of clinical and operative work has been satisfactory will be eligible to appear for a postgraduate degree in plastic surgery. This should be called M.Ch. (Plastic Surgery) to distinguish it easily from the M.S. in general surgery.

The aim of such a training programme should be to produce scientists and not merely technicians. This should be borne in mind throughout the period of training. In order to achieve this, emphasis should be on the study of basic sciences, research in clinical subjects and on experimental surgery.

STANDARD REQUIREMENTS AND SCHEME FOR POSTGRADUATE TRAINING IN SPECIALITIES : PLASTIC SURGERY

AIDE MEMOIRE

PRESENT POSITION

THERE are about six centres in the whole country with facilities for training of plastic surgeons. These centres are manned by surgeons who are adequately trained to be teachers in this field devoting their full time to this speciality.

At certain other centres surgeons with some training in plastic surgery are engaged largely in general surgical practice.

At yet other places, surgeons with inadequate training in plastic surgery are engaged in this speciality as a side line.

There is everywhere in the country a great and unsatisfied need for skilled plastic surgeons.

OBJECTIVES

It is estimated that there is a need for 200 to 300 fully trained plastic surgeons to satisfy the needs of this country. It is recommended that the available centres for training in this country should be utilised to the best purpose for training of plastic surgeons whose standards should be so good that they command spontaneous recognition as competent specialists in this rather difficult and new field. They should be capable of starting and developing centres for plastic surgery where essential supporting services exist (usually in teaching hospitals). The first thirty centres should be spread out in such a way that from every town and village, to reach it, a person does not have to cover a distance more than 200 miles requiring 12 hours as his time and Rs. 10 as his cost.

As these centres develop, the best among them will become available as regional training points which would be helpful for increasing the output of specialists. In this way within ten years there should be sufficient training facilities of a high quality for the needs of the whole country.

SELECTION

1. The candidates must have passed the M.B.B.S. examination not later than at the second attempt;

2. done one year of resident house-surgeonship in a recognised hospital of which six months must have been in general surgery;

3. had one year of training in rotation in at least three of the following specialities—orthopaedics, E N T , anaesthesia, casualty, pediatrics or radiotheraphy;

4. have concurrently completed one year of approved training in basic sciences in the following subjects—anatomy, physiology, pathology, bacteriology and biochemistry;

3. One anaesthetist with D. A. and practical experience with difficult maxillofacial and pediatric cases.
4. Dental technician with adequate workshop training.
5. Dental surgeon with training and experience in maxillofacial work.
6. Physiotherapist, occupational therapist and speech therapist. These rehabilitation personnel may be shared with collateral departments, such as orthopaedics, chest surgery and neurosurgery.
7. Photographer/artist.
8. Steno-typist and records clerk.
9. Laboratory technician.

B. Physical Facilities

1. Bed strength/operative turn-over. There should be at least ten beds per candidate and 200 operations per year. The minimum requirement of such a teaching department should be 40 beds. This may include beds in affiliated institutions.
2. Operation theatre to be made available on all days of the week for plastic work.
3. Dental workshop.
4. Photography section.
5. Room for records, models and museum.
6. Follow-up department.
7. Departmental library.
8. Research laboratory.
9. Residential accommodation for trainees. In addition a training and a research section for 'burns' consisting of 10 beds with adequate staff and facilities are recommended. This section should not be expected to deal with all the cases of burns in the hospital.

The training centre should have facilities for taking up reconstructive surgery for leprosy cases, if located in areas where the disease has a high incidence.

Supporting services which enhance the teaching potential of the centre are pediatric, orthopaedic and radiotherapy units.

At least a third of the floor space should be made available for teaching, research and ancillary facilities.

A detailed list of equipment for the department is not provided as this must be left to the choice of the individual institution.

an elementary knowledge of biophysics, biomechanics, medical electronics and statistics. This training can be carried out concurrently during the pre-speciality period in the basic sciences department of the teaching institution, preferably in the afternoons.

RESEARCH AND EXPERIMENTAL SURGERY

The aim is to create an attitude of critical enquiry which will help the student during and after his training. The methodology of research is hence important. Research may be clinical or experimental or preferably both. The teacher himself must be research-oriented. He should be familiar with the various methods of enquiry. There should be adequate facilities of a reference library, clinical and experimental laboratories and experimental surgery. A central animal house with experimental surgery rooms and equipments should be available at all training institutions.

EXAMINATION FOR THE M. CH (PLASTIC)

Shall include:

(a) A thesis consisting of a commentary or experimental work showing evidence of the candidate's original thinking in the study of a particular problem in detail.
(b) 20 certified case records representing his own work in diverse fields of plastic surgery.
(c) Record of the practical work of each candidate should be maintained and submitted. This should include record of experimental work which should be signed by his teacher.

Written Examination

Should consist of three papers:

Paper I—Plastic Surgery (General)
Paper II—Plastic Surgery (Regional)
Paper III—Fields closely allied to Plastic Surgery including Basic Sciences.

Clinical, Practical and Viva Voce Examination

(d) The thesis shall be submitted three months before the date of commencement of the examination. The case records shall be submitted at the time of the practical examination. No candidate whose thesis has not been approved shall be admitted to appear in other parts of the examination. A candidate whose thesis has been approved but who fails in the rest of the examination shall be exempted from submitting a fresh thesis for a subsequent examination.

STANDARD REQUIREMENTS FOR TRAINING CENTRE

A. Staff

1. One plastic surgeon with at least two years of practical training under an internationally recognised specialist in the field, and three-year experience in the practice of the speciality after his training.
2. One assistant with at least two years of practical training as indicated above.

thyroid, breast and some minor conditions. They of course continue to treat the other conditions as well, if the respective speciality has not grown in their institution. The result is that as general surgery has been largely oriented towards abdominal surgery the training of general surgeons is overshadowed by undue emphasis on abdominal surgery. The training is therefore lopsided.

Our main objective is therefore to give our trainees the best of training. To reach the objective, our trainees must first be trained in the basic sciences, i.e. anatomy, physiology, biochemistry, bacteriology and "principles of surgery" which are common to all branches of surgery. During this preliminary training, to absorb the "principles of surgery" and to get the necessary background and broad vision, which is required of a specialist, the trainee should be made to work in rotation with men who by training, experience and dedication have "mastered" their own branches.

Having completed his preliminary training, he should then concentrate on any of the branches he wants to take up ultimately, i.e. general surgery, orthopaedic surgery, plastic surgery, genito-urinary surgery, neurosurgery, etc.

With this end in view, the following training and examination schemes are suggested:

(1) After graduation, one year of housemanship, which should include at least six months in any branch of surgery.

(2) Then two years of rotation to hospital is recommended, including internal medicine, orthopaedics, plastic surgery, E.N.T. surgery, anaesthesiology, genito-urinary surgery, neurosurgery.

Total—three years after graduation.

Where there is not any of the specialised units, the candidates will work in a general surgery unit doing this specialised work.

At the end of the 3rd year after graduation, the candidate will sit for the part of M.S. examination which is common to all branches.

(He has to pass the Part I examination at least one year before he sits for his Part II examination.)

At the end of the 2nd year, he will then select his own branch of speciality (having worked in almost all branches of surgery, he will be in a better position to indicate his choice): (1) general surgery; (2) orthopaedic surgery; (3) plastic surgery; (4) genito-urinary surgery; (5) chest and cardiovascular surgery; and (6) neuro-surgery.

He will be required to spend at least two years in the speciality, before he is allowed to sit for the final and Part II of the M.S. examination.

This will mean that it will take five years after graduation to become a specialist surgeon.

POSTGRADUATE TRAINING IN SURGICAL SPECIALITIES

PROF. R. N. SINHA, F.R.C.S.

Head of the Department of Plastic Surgery, Patna University

A time has come when we should think of a co-ordinated programme to give our surgical trainees, irrespective of the speciality they choose, an adequate background. It is felt that the postgraduate training in every speciality should be split into two parts. Considering specifically the surgical specialities, i.e. general surgery, orthopaedic surgery, chest and cardiovascular surgery, plastic surgery, genito-urinary surgery, etc, it is strongly felt that the first part of their training, lasting two years after graduation, i.e. one year after housemanship, should be devoted to basic sciences, i.e. anatomy, physiology, biochemistry, pathology, bacteriology, and pharmacology. It it also felt that the standard of knowledge of basic sciences in our postgraduate students is not adequate and a mere training in basic sciences for only six months, as has been envisaged in certain quarters, is not enough. To ensure proper utilisation of this training, there should be an examination after every two years in basic sciences and in principles of surgery. It is suggested that in order to ensure a uniform standard this training end examination should be common to all branches of surgery. Unless emphasis is laid on proper training in basic sciences of our postgraduates, we shall continue to manufacture technical craftsmen, not scientific surgeons.

It has been suggested in some quarters that candidates who wish to offer M.S. in some surgical specialities other than general surgery should do so only after passing M.S. in general surgery, which should take normally at least three years after graduation. Nowhere in the world, where there is provision for a separate "examination" (as in Speciality Boards in America and Canada) in the specialities, is the passing of a postgraduate examination in general surgery insisted upon. The general trend is for two years of postgraduate "work" in general surgery.

Perhaps this insistence on a postgraduate examination in general surgery stems from the irrational equation of "general surgery" with "principles of surgery." Nobody will deny that before taking up any branch of surgery it is absolutely essential to master the "fundamental principles of surgery," which are common to all branches of surgery.

In this context, it is worth while taking a new look at what meaning is attached in our country to "general surgery." There was a time when a surgeon used to treat, to the best of his ability and knowledge, all surgical conditions from head to foot. But if one has to keep a reasonably good standard specially in teaching institutions, one can only do so at considerable risk of watering down the standard. But with the gradual evolution of specialities like orthopaedics, plastic surgery, neurosurgery, chest and cardiovascular surgery, genito-urinary surgery, and cancer surgery, "patient-care" in these subjects has of necessity devolved on the respective specialities. The general surgeon has been mainly left with abdominal surgery,

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training should be carefully assessed during this period, and unsuitable candidates should be dropped from the course at the end of this period.

Trainees should work as full-time assistants in the unit, and private practice should not be permitted during the period of training. There should be a regular revision of resident and emergency duties for all trainees. In the day-to-day work of the unit, as they prove their competence, they should be given increasing responsibilities to carry out the treatment of patients. They should maintain a work diary in which should appear recorded comments and notes on all the patients in whose treatment they had some share.

The training programme should also include the following:

1. a course of orientation lectures covering the whole scope of plastic surgery;
2. seminars in which trainees take active part;
3. review of literature during which every trainee presents abstracts and critical reviews of important publications;
4. case discussions and treatment planning sessions, in which trainees apply their minds intensively to the study of selected cases, presenting their analysis of problems, objectives of treatment, and the detailed treatment plans;
5. practical training in the techniques of plastic surgery; and
6. a general course of instruction, mainly practical, in fields closely related to plastic surgical work (anaesthesia, surgical care of infants, dental work in plastic and maxillofacial surgery, physiotherapy, occupational therapy, speech therapy and rehabilitation in general clinical photography and modern methods of medical illustration and documentation, methods and tools of clinical research).

Throughout the period of training, postgraduates should be encouraged to visit basic science departments to gain fresh knowledge of anatomy, physiology and pathology related to their research or clinical work in the plastic surgery unit. If possible, the postgraduate should work full-time for a certain number of weeks in each basic science department.

A series of extension lectures or seminars on basic themes should be organised for postgraduates and the staff of all clinical departments in the institution, with emphasis on integration of basic and clinical sciences.

METHODS OF ASSESSMENT

Training in plastic surgery is adequate when the candidate has reached a level of knowledge, experience and judgement sufficient to:

1. analyse complex plastic surgical problems into their basic elements, find effective solutions for each, define objectives and priorities in treatment, make a safe working plan best suited to the needs of the patient, and to carry the plan through successfully without danger to the patient; and
2. observe and evaluate his results objectively, find deficiencies, trace them to imperfections in planning and techniques, and improve on these.

REPORT OF THE SUB-COMMITTEE ON PLASTIC SURGERY

PROF. C. BALAKRISHNAN

Chairman and Prafestor af Plastic Surgery, Upgraded Department of Plastic and Maxillafacial Surgery, Medical College, Nagpur

DR. SURINDER MAN SINGH

Rapparteur and Assaciate Professar af Uralagy, All-India Institute of Medical Sciences, New Delhi

IT is necessary to have a degree in plastic surgery, awarded by examination, to indicate adequate training and competence to practise this speciality.

NOMENCLATURE

The degree in plastic surgery should be called M.Ch. (Plastic).

SELECTION OF POSTGRADUATE STUDENTS

The candidates should have obtained the M.B.B.S. degree, served one year of resident house-surgency and worked for two years in a good surgical environment. They should also have satisfied one of the following criteria:

1. obtained the M S. or equivalent qualification in general surgery, orthopaedics, or otorhinolaryngology;
2. experience as a recognised surgical specialist in the Army Medical Corps (the criteria of such recognition are known to be strict);
3. passed a qualifying examination in basic sciences and the essentials of surgery, after a course of training for one year in general surgical units, and one year in special surgical units with concurrent training in the basic sciences;
4. been a graded surgeon for two years in the Army Medical Corps; or
5. held a resident post in a plastic surgery training unit for two years already, and proved suitable for advanced training in plastic surgery. (This criterion is applicable only if such a candidate has been unable to satisfy criteria (1) or (3) due to the exigencies of his posting in the plastic surgery unit. No part of one year's house-surgency will be counted for this purpose as resident post.)

DURATION, CONTENT AND METHODS OF COURSE

Candidates can be trained for M.Ch. (Plastic) degree in two years.

There should be a period of preliminary training for three months in the fundamental principles and basic techniques of plastic surgery. Aptitude and suitability for advanced

MASTER'S DEGREE IN NURSING

DR. S. KRISHNAN AND A. GUPTA

College of Nursing, New Delhi

I. *Philosophy and General Objectives*

"THE primary function of nursing education is to provide qualified nurse practitioners to meet the diversified nursing needs of persons requiring health services." The nursing profession in a country defines the nursing needs of the country and in turn determines the types of programmes that prepare the various categories of nurse practitioners on various levels to meet the needs within the total health services of the country.

"Two distinctive levels of preparation are needed: (1) basic preparation, and (2) advanced education for specialisation. The basic education aims at preparing individuals for the practice of nursing." A basic or post-basic preparation leading to a Baccalaureate Degree in Nursing with a broad foundation in the physical, biological and behavioural sciences and in the comprehensive nursing care not only enables practice in caring for patients on a humanistic and scientific basis but also is the basis for advanced education leading to a Master's Degree in Nursing.

The master's programme re-inforces the foundation preparation, and deepens and widens the basic concepts of nursing. It is designed to prepare nurses for leadership positions in teaching and administration in all types of educational programmes, in supervisory and administrative positions in nursing service in hospitals and public health fields and in research work in nursing.

II. *Students*

The graduates must have at least 2-3 years of working experience achieving increasing competency and increasing awareness to the many nursing problems and needs of the country and an increasing sense of responsibility and interest in nursing. The graduates thus should be led to a felt need for further formal preparation on the master's level to enable them for better contribution and better leadership.

The experience also provides opportunity for self-evaluation and development of their abilities and specific areas of interest as a basis for appropriate decisions in the choice of advanced education and professional service.

III. *Curriculum*

A master's programme in nursing should be organised for a period of two years similar to other disciplines at the master's level within a university.

In order to accomplish the objectives in consistency with the set philosophy the curriculum should consist of learning experiences mainly in the following areas.

Adequate training brings the candidate to the 'take-off' stage and as a junior specialist with a sensitive feed-back control to correct himself he can continue his training without guidance from a teacher. The basic principle of assessment is to test whether the candidate has reached this take-off stage, and whether he has sufficient judgment to be a safe specialist.

Credits should be given for (1) original ideas, (2) exact knowledge of all important facts, (3) scientific reasoning, (4) clarity and force of presentation of ideas, and (5) a good memory for details.

Debits should be served for (1) wrong fundamentals, (2) omission of important facts, (3) evasion of crucial points, (4) failure to correct absurdities and contradictions, and (5) irrelevant padding in the presentation of ideas.

For the degree of M.Ch. (Plastic), a thesis or a dissertation is necessary, which is a great test of scientific orientation and creative thinking in the detailed study of a chosen subject. It should be submitted three months before the examination and should be approved by all the examiners before the candidate can sit for the examination.

The written test should consist of three papers:

(I) Plastic Surgery, General;
(II) Plastic Surgery, Regional; and
(III) Fields closely allied to Plastic Surgery.

A certified record of work carried out independently by the candidate during his training should be evaluated by the examiners during the clinical and oral parts of the examination. The candidate should have carried out a fair variety of major plastic work on at least twenty patients, independently, before taking the examination.

The clinical part of the examination should consist of one long case and several short cases, testing in detail the candidate's ability to assess cases, to plan treatment, and to carry out major operative procedures safely.

The oral examination should finally assess the candidate's shortcomings and special merits to be a safe specialist.

There should be at least three examiners, and the candidate should pass only if all the examiners agree.

It is also very important to have faculty members with a high degree of integrity of personality.

VI. *Administration*

(Responsibilities of Institution/University)

A College of Nursing which gives a baccalaureate degree in nursing comparable to other baccalaureate degrees offered by the University and which has the potentialities for further expansions and developments needed for master's programmes may take the responsibility to administer a master's programme in nursing.

The administration (Governing Body of such a College) must recognise the need of such qualified personnel in nursing and must establish a unit in nursing on a completely equal basis with other such educational units of the Institution/University with sound policies that ensure both the academic and administrative freedom as well as control.

It should provide the students and staff with adequate teaching and living facilities, that is a suitable academic environment, with access to national and international health and educational agencies, access to different library facilities and access to inter-departmental University facilities.

The administration must be prepared to give the faculty a scale of pay and other conditions of service comparable to that of similar educational units of the Institution/University in order to secure a steady and productive faculty competent to implement a sound programme.

REFERENCE

Nursing Education Facilities: Programming Considerations and Architectural Guide—U.S. Department of Health, Education, and Welfare Public Health Service.

General Preparation

1. A course in Educational Philosophy, Sociology and Psychology which gives further understanding of the 'process of learning'.
2. The above course forms the foundation for another course in Principles and Practice of Education dealing with the process of 'guiding learning',
3. and also forms the fundation for yet another course in Evaluation and Measurement which deals with the process of measuring the progress of learning in terms of desired changes in behaviour.
4. A course in Research Methodology deals with the scientific method of solving problems.
5. A course in Communication Skills deals with effective and modern means of mass communication.
6. A course in Elementary Statistics and its application in nursing education and service.

Professional Preparation

These courses are built on the foundation laid by the said general courses and applied with special reference to nursing education, nursing service and their administration. These form the hard core of a Master in Nursing curriculum.

The curriculum should also be well enforced by providing about one-third of the total learning experiences in actual practice in the professional fields These may be in the form of supervised teaching, field work in administration, in comprehensive bedside nursing care and research experiences. The weightage of both experiences offered should be in accordance with the option of the specialisation.

Field work experience in research methodology should be in the form of writing a *thesis* equivalent to the weightage of any other course/paper in the curriculum. This is considered essential to gain some practical knowledge and beginning skill in conducting scientific studies, particularly until doctorate level programmes are established for courses in the country.

IV. *Assessment of Students' Progress in the Course*

Students are required to do a great deal of independent reading and independent work on problems and projects. Therefore internal assessment and grading of day to-day achievement is highly desirable for the student to know his own progress as well as to get the credit for his efforts This internal assessment of the year's/semester's work should be included in the final University grades. The weightage of internal grading may be determined on the basis of the adequacy of the faculty in terms of their quality and quantity to ensure the validity, objectivity and reliability of the old assessment. 25·33 per cent of the total marks for each theory paper and up to 50 per cent for each practical paper may be allotted to internal assessment.

V. *Faculty*

Members must have at least a master's degree in nursing while a doctorate degree is very desirable. At least 8-10 years of total experience in nursing preferably both in service and in education with at least five years of teaching experience on a University-level nursing education programme is desirable. Experience in independent research work or assisting with research is also very desirable.

the practitioner is in the laboratory or the place of research activity. The study of human behaviour cannot take place in test tubes. The laboratory is at the bedside, in the home and in the community, wherever there are people! The artificial barriers between the physical and behavioural sciences are gradually breaking down as the interdisciplinary relationships begin to emerge. Likewise the gap between pure and applied or utilitarian research is slowly diminishing. One is meaningless without the other.

More and more research projects are being conducted in hospitals and health agencies. Thus, in health and medical research, the practitioner becomes inevitably involved. And who is more involved than the nurse who spends her time, day by day and hour by hour, in the midst of abundant data about people—in health and sickness, happiness and sorrow, birth and death. Whether nurses choose so or not, by reason of their proximity to the patient, nurses are increasingly expected to participate in research projects as a regular part of their work in hospitals and in the community.

Nurses have already entered the field of basic clinical and epidemiological research both as individuals and as members of an interdisciplinary team. However, they are often part of the team without actually being involved in the overall planning and execution of the research project. They may be requested to provide certain data for the project simply as another duty or task to be performed. In this situation the nurse may be indifferent or may even resent the collecting of data. She may feel that it seriously interferes with giving nursing care. She may also find it difficult to remain objective. For example, when she observes or extracts certain personal information for the purpose of the project she may be surely tempted to enter into the situation and interfere. Therefore, without adequate understanding of research and appreciation of its significance to her practical sphere of work, the potential of the nurse is limited as a participant in research. If, however, the nurse is adequately prepared, she occupies the most enviable position of all for observing and recording the human drama going on around her.

So far we have discussed two major reasons why nurses need and would benefit by postgraduate education in research:

1. as consumers of research relevant to their field of work and profession, and
2. as participants in research related to the medical and health fields.

There is yet another rapidly developing area of research where nurses themselves become the initiators or chief investigators. This is the area of nursing itself. The function of research in nursing, as in any profession, is the systematic search for, and the testing of, facts and principles Findings will add to the substantive body of knowledge the nursing practitioners use to improve nursing care.

POSTGRADUATE EDUCATION OF NURSES FOR RESEARCH

PAULINE E. KING, PH.D.

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AT first glance, to many people, the topic of postgraduate education in research for nurses may seem premature. The vast majority of nurses are trained in hospital schools of nursing which emphasise the practical rather than the academic content of the curriculum. Few have the educational background to enable them to participate intelligently in research which is basic to the development of an open, enquiring mind.

Perhaps the first question we should consider then is, "Is it necessary?" Already nurses are criticised for leaving the bedside; and now it is suggested that nurses take on the further rather academic responsibility of research. Secondly, if research is accepted as a legitimate function in nursing, "What is the scope and at what levels can nurses use and/or contribute to research"? Finally what are the anticipated functions of nurses in research in India at present and in the immediate future? How can nurses be adequately prepared to fulfil the expectations of this new and challenging role?

"IS IT NECESSARY?"

Considering the first question, "Is it necessary?", the fact that the topic arises is an indication of a felt need. It is a need not only confined to nurses. Research has become a necessity in all fields of endeavour. In fact, in our modern society, research has almost become a way of life. The contribution of research to knowledge and the progress of mankind is indisputable. We cannot afford to do without it.

The advancement of science in the past century has greatly accelerated the rate of social change. It has not only resulted in "population explosion" but also in an "explosion of knowledge." The problem inevitably follows, how are we to put all of this new knowledge to use and make its benefits available to man? Often valuable research remains unused on a shelf because it is not written in a form comprehensible to the consumer. Research reports are usually written in a style and language not easily understood by persons unacquainted with research methods. Without a basic knowledge of research how are practioners to discriminate and select for their use the findings that are really true and valid?

Until recent years research was confined largely to the physical sciences. Thus, medicine and nursing were naturally concerned with the treatment and meeting the physical needs of the patient. Now with the advances in psychology and the special sciences the trend is toward comprehensive care, i.e. going beyond the physical needs of a patient to consider the social and psychological needs as well.

The focus in research preceding the trend in practice is also shifting from the physical to the social and psychological dimensions of man. The significant change which direclly affects

"Nursing—What it is and What it is Not?" These reports were based upon data collected from literature and reports and detailed accounts of observations made from her own experience.

Appalled at the prevailing conditions in hospitals of her time, Florence Nightingale sought to change the situation through improving the education of nurses. The schools of nursing established by her were independent educational institutions which recruited the better educated women of the day. The result was a revolutionary change in nursing practice which not only uplifted nursing as a profession but proved itself at the bedside in improved patient care.

After Florence Nightingale, nursing schools became hospital schools under the control of the medical profession and hospital administrators, a factor which did much to retard the development of high quality nursing. The situation then sounds somewhat familiar to conditions affecting the development of nursing in many places in the world today. There was a multiplication of hospitals and sanitoria with the unrestricted development of the training of nurses as part of the nursing staff of the institutions, operating on the principle of dependence upon the students for all of the actual nursing work. There was a persistence of low standards for admission and a lack of qualified faculty and facilities for teaching. Many very small hospitals continued to operate schools which lacked clinical resources for an adequate training programme for nurses. As a result of these problems the first Committee on Research in Nursing was appointed in 1896 under the National League for Nursing Education in the United States of America. Subsequently, research became the responsibility of professional organisations rather than the university since nursing was late in being accepted in university programmes.

Early research centred around standardisation and unification of nursing standards in an effort toward improving the training and organisation of nursing schools. Later, attention was directed toward the revision of curriculum studies, cost analysis, time and activity studies and the interests and personality traits of the nurse herself as factors influencing the quality of nursing care. The emphasis in all of these studies was on education in the belief that better education would result in improved practice. Many would not classify such studies as research but they were the beginnings of a scientific approach toward the improvement of nursing care. The results have focussed the attention of hospital and nursing school administrators upon problems in both education and service.

The trend in nursing research for the future is less concentration on the nurse and more on the art and science of nursing. There is a recognised need to establish the scientific basis of what we do. We need to develop new techniques and improve the old techniques through research. Studies in function are geared to definition of the problem, deciding the course of action and appraisal of results, and the delegation of functions.

Studies in service problems include patient care plans, such as home care plans, and grouping patients by kind and amount of nursing care rather than by medical speciality, e g. the recovery unit, progressive care unit, etc. In education, the trend is toward development of newer and more effective methods of teaching. More important, the future focus is on the patient as the recipient of comprehensive care. Few nurses as well as other personnel working directly with patients are prepared to treat and meet other than the physical needs of patients,

research activities will serve to stimulate the nurses' thinking and cultivate an objective and positive attitude in their approach to nursing problems.

For the graduate of the degree programme in nursing similar goals may possibly be achieved in postgraduate courses of shorter duration, provided the content builds upon a foundation already laid in the basic programme. However, such a course is recommended only where opportunities for higher study on the Master's level are not available. At present in India there is only one Master's programme in nursing. A limited number are given opportunities to study abroad. Therefore, it is conceivable that there would be a number of graduates from B Sc. programmes in nursing who would be interested and benefit by a special short postgraduate course in research. Thus, more nurses, and significantly those in leadership positions, would be made available as participants and supporters of research in nursing and related medical and health fields. However, for objectives beyond this level, education on the Master's level is highly essential.

To function as a participant directly and fully involved as a member of the research team requires a greater depth of knowledge in the area of specialisation and facility in the use of research methods and tools. The baccalaureate is the essential base for specialisation. The Master's course which is designed for specialisation usually includes courses in research and the student is required to carry out a study of simple design. Thus, the nurse who completes a course on the Master's level is better prepared to share equal responsibility in the research team and also design and conduct small individual reasearch projects in her own special field. Post-Master's education in the form of conferences or workshops is useful to further prepare these nurses to participate in and/or initiate special projects of a more complex design.

The highest level of function in research as individual researcher and/or director of a research team requires postgraduate preparation on the doctoral level. In the U.S.A., the need for nurses on this level was felt so urgently that a programme of study on the doctoral level offering a major in research was established in the Department of Nursing Education, T.C. Columbia University. It is the first of its kind and its main objective is to produce nurse scientists who can direct research in nursing. In the past there have been nurses who have made outstanding contributions in research and did not have a doctoral degree. Such nurses however are the exception and were able to make a contribution by reason of long experience and association with others who were actively engaged in research. However, the rare and infrequent contribution of a few is not enough to establish nursing as a science based upon a scientifically tested body of knowledge. There is a need for nurses who are interested in and able to consider research in nursing as a career and speciality in nursing. Only then will steady progress in nursing be assured. Only then will we achieve the desired goal of quality in nursing care.

research. It is at this point our thinking becomes specific. The objectives to be realistic must be stated in terms of the available resources and existing standards of nursing practice within the country. Thus, in formulating objectives of postgraduate education for research for nurses in India, certain factors about nursing as it exists today and the emerging trends for the future must be taken into consideration.

Two distinct categories of professional nurses are now co-existing in India, the certificate graduate and her collegiate colleague with a B.Sc. degree. The graduates of certificate courses are by far in the majority. However, although graduates of collegiate programmes are yet small in number by comparison, they occupy leadership positions in nursing and thereby exert a powerful influence within the profession.

The educational background of the two programmes in nursing are significantly different so that it is reasonable to anticipate that separate postgraduate courses in research will be necessary to meet their respective needs. The level of general education prior to professional training required for admission to certificate courses in nursing is S.S L C. Increasing numbers, however, have also had pre-university training or its equivalent.

The majority who are accepted for admission in B.Sc programmes in nursing have had pre-university or higher levels of general education. The requirements vary slightly from state to state and from one university to another depending upon the faculty to which the nursing programme is assigned.

Graduates of both the certificate and degree programmes need postgraduate education in research if they are to function intelligently even at the first level as consumers of research. A few of the B.Sc. programmes may include this as an objective of the basic course, but how far it is a general practice is not known. Before setting up postgraduate education to prepare nurses as consumers and beginning level participants in research it would be well to survey the curricula of the colleges of nursing for the type and amount of content relevant to research.

In observing and comparing the certificate and degree programmes in nursing, postgraduate courses in research beginning at different levels would seem desirable. For the graduates of certificate courses a certain amount of experimentation may be necessary to determine the form and level of content required. Should postgraduate study in research be a speciality and offered to a selected few or should it be integrated at least into the general postgraduate courses now offered to nurses in education and administration? Are there other related professional and technical groups at the same education level with whom nurses could share in an interdisciplinary programme of postgraduate education for research?

However the postgraduate course is designed, it is clear that the amount and depth of research knowledge which can be absorbed by the graduates of the certificate programme in nursing is self-limited. The objectives cannot reasonably be extended above the first two levels of function as consumers of research and participants without full involvement in the research project. Nevertheless, if these two objectives can be achieved, the effort would be well spent. It is hoped that new knowledge derived from research would eventually be reflected in improved patient care. Nurses would be more ready to accept and support research activities in their working environment. They would be better prepared and willing to participate as observers and otherwise assist directly in the collection of data. In return, participation in

research activities will serve to stimulate the nurses' thinking and cultivate an objective and positive attitude in their approach to nursing problems.

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POST-BASIC DEGREE COURSE IN NURSING AT THE COLLEGE OF NURSING, TRIVANDRUM

LUCY PETERS

Director of College of Nursing, Trivandrum

TILL 1942, nurses from Kerala were sent to other States in India and abroad to take post-certificate and post-basic degrees in nursing. As a result of expansion in the health programmes during the Five Year Plan periods and also to meet the demands of national emergency in the recent years, more and more schools for training nurses were opened in this State. Consequently, to meet the increasing demand for well prepared nurse teachers, Supervisors Administrators in nursing, an advanced educational programme in nursing had to be planned. Advances in modern medicine require nurses with greater comprehension and efficiency in patient care and hence it was felt that it would certainly provide better nurses if a post-basic programme was developed at a university degree level. Moreover this will provide opportunity for continuing education for Certificate Nurses to generate latent potentialities in them and thus advance nursing service and nursing education. No college in India was offering a post-basic degree programme in nursing and many nurses aspired to have university education for which no institution had any provision. Nursing leaders of our country in their continuous effort to provide for this long felt need enlisted the active assistance of the Faculty of Medicine, University of Kerala, to start higher education for nurses at the University level. The Government of Kerala was generous in organising the post-basic programme in the School of Nursing, Trivandrum, and upgrading the School into a College in 1963.

As a preliminary step, a Diploma Course of 11 months' duration in teaching and administration in nursing was instituted at the School of Nursing, Trivandrum, and the School was affiliated to the University of Kerala in 1960. This programme continued until 1962 and a B.Sc. degree programme was then instituted. The admission requirement to the degree programme was fixed at a pass in pre-university course or an equivalent examination of a recognised university. Most of the nurses in the State did not possess such a qualification. Therefore it was felt necessary to design a special course for nurses equivalent to the pre-university course to qualify them for admission to the degree course. A pre-degree course in nursing of ten months' duration was started by the University of Kerala at the School of Nursing, Trivandrum, in the year 1963. Admission to this course is limited to ten. The subjects taught in this course are English, Social Studies, Physics, Chemistry and Biology.

The post-basic degree course in nursing of two years' duration was started in December 1963 with ten students. Only nurses with the basic qualification of pre-degree in nursing or equivalent examination (Intermediate in Science) of a recognised university and with a minimum experience of three years in nursing are admitted to this course. Admission to this course is

open to candidates from all states in India and the number is limited to fifteen. Out of this, ten seats are reserved for the students who have passed the pre-degree examination in nursing and the test for direct admission. A limited number of candidates from Thailand is also admitted to this programme. At present, there are twentyfive students undergoing this course. The candidates are from Kerala, Madras, Mysore, Andhra, Maharashtra, Rajasthan and also from Thailand.

The content of the curriculum includes study of English, Social and Biological Sciences, Public Health, Clinical Nursing, Administration and Nursing Education. Candidates who possess the diploma or post-certificate qualification in teaching, administration or public health nursing are exempted from the practical training in their respective fields of specialisation. An outline of the course is appended. Admission to both pre-degree and degree courses in nursing are made in July every year.

Rockefeller Foundation provided the services of a Nursing Adviser who was directly instrumental for developing this programme. The medical college and also science and arts colleges in the city willingly participate in the programme. Scholarships are available for the deserving candidates for the B.Sc. programme from grant awarded by Rockefeller Foundation, and T.N.A.I. has also instituted limited scholarships for students undergoing pre-degree and degree courses in the College.

SYLLABUS FOR THE B.Sc. DEGREE COURSE IN NURSING FOR QUALIFIED NURSES

First Year Degree in Nursing—

		No. of hours Theory	Practical
Part I. English	...	125	
Part II. A. Biological Sciences:			
1. Anatomy and Physiology	...	65	40
2. Microbiology	...	20	10
B. Social Sciences:			
1. Psychology, including Mental Hygiene	...	68	
2. Sociology	...	70	
3. Economics	...	20	
4. Trends in Nursing	...	20	
Part III. Health Subjects:			
1. Preventive Medicine	...	60	10
2. Statistics	...	24	
3. Nutrition and Dietetics	...	50	24
4. Physical Education	...	10	10
Part IV. Clinical Nursing		145	200
		657	294

Second Year Degree in Nursing—

		No. of hours Theory	No. of hours Practical
Part I. Nursing Administration:			384
1. General Administration	...	30	
2. Personnel Management and Public Relations	...	20	
3. Nursing Service Administration	...	35	
4. Nursing School Administration	...	30	
5. Library Science	...	10	
6. Citizenship	...	10	
7. Public speaking	...	20	
Part II. Nursing Education:			30 (by each student)
1. Educational psychology	...	30	
2. Principles of Education and Methods of Teaching	...	40	
3. Audio-Visual Aids	...	20	
4. Counselling and Guidance	...	30	
5. Educational programmes in Schools of Nursing	...	60	
Part III. Public Health Nursing	...	60	384
		385	798

Experience, during the 2nd and 3rd terms of the second year:

1. Nursing Administration—2 months (1 month in collegiate hospitals and School of Nursing on the Medical College campus, and 1 month in major hospitals outside Kerala).
2. Nursing Education—2 months (10 hrs. practice teaching and 20 hrs. classroom teaching by each student; supervision of students in wards).
3. Public Health Nursing—2 months (1 month in Kerala and 1 month outside Kerala).

specialisation would be for continued improvement of nursing service and nursing education. Recently, during a small survey in connection with a postgraduate programme, a few Sister Tutors and Ward Sisters of different States in India were interviewed to get their opinion on inclusion of medical-surgical nursing at a postgraduate level They were unanimously in favour of including such a course. The reasons given by the Ward Sisters to include the course were that it would result in gaining knowledge, increasing the depth in knowledge, keeping up with present trends and also benefiting the teaching and supervision in their wards.

The postgraduate courses for nurses in India mainly aim at preparing nurses in teaching and administrative positions. Finer in his extensive study, *Nursing Service Administration*, stated that "the primary duty of nurses is the thorough mastery and sufficient practice of the clinical elements of patient care, basic and specialised. before she wants to be an administrator, supervisor or a teacher in nursing." If this statement is accepted, there is a great deal to be done to give the nurses thorough mastery and sufficient practice in the clinical elements of patient care, because, at present, the basic preparation and experiences which follow do not seem to provide enough opportunities to be an expert in clinical nursing.

A beginning has been made for clinical specialisation especially in the field of public health nursing. A course each in pediatrics and psychiatry also has been started One short-term course in operation room technique is being carried out. Considering the importance of clinical specialisation to meet the needs of our country, this beginning is very small There is need for a thorough study in this area. Possibilities of having two types of courses, one a short-term course to serve as a supplementary to basic preparation, e g operation room technique, isolation technique, on cardiology, neurology, etc., and another an advanced course for clinical specialisation in pediatrics, midwifery, public health, psychiatry, etc. to prepare nurses for teaching, supervision and administration in the same fields. These programmes have to be carefully planned and organised so that they would meet the needs of nurses who are already in the field and are eager to learn more and wish to stay in a speciality in order to improve themselves and the clinical situation. In these courses, there should be adequate facilities for practical work and also for self-study by students. Students may be given patients to be taken care of by application of knowledge in an integrated manner and to observe how this helps in improved nursing care and encourages them in self-evaluation In an advanced course, students may be given opportunities for solving problems.

Programmes of clinical specification might be an answer to keep nurses in the fields in which they like to stay. Today even if a nurse wishes to stay in her chosen clinical speciality, she has no opportun ties for improvement. Then she leaves the field and looks for teaching and supervision and realising that there are plenty of teaching and supervisory opportunities in the clinical field. At the postgraduate 'evel, many problems connected with clinical nursing also can be considered. Very little has been done so far in terms of research in nursing and, when clinical specialisation is taken up at the postgraduate level, the research methods also would be included. Today, nurses are finding it difficult to go ahead due to lack of facts Fact-finding methods in clinical nursing would be a great contribution towards improvement and progress. In one of the ICN publications it is stated that the unique function of the nurse is to assist the individual, sick or well, in the performance of these activities contributing to health or its recovery (or to a

peaceful death) that he would perform unaided if he had the necessary strength, will or knowledge. It is likewise her function to help the individual gain independence as rapidly as possible. Today, nursing seems to be deviating from the above definition and nurses are busy performing many other functions which take them away from the patient. Although everything that a nurse does is ultimately for the patient, one cannot ignore the fact that the real sense of nursing, i.e. doing things for the patient directly, is very limited. Would clinical specialisation bring back a nurse to her patient? It is worth attempting to organise such courses with the assumption that nurses would appreciate the value of nursing when studied in depth and give nursing care by application of basic principles. This might give them the urgency to pay priority attention to bed-side nursing. Clinical specialisation at the postgraduate level might be an answer to many of the problems and dissatisfactions about nurses and nursing.

REPORT OF THE SUB-COMMITTEE ON NURSING EDUCATION

T. K. ADRANVALA

Chairman and Nursing Advisor, Directorate-General of Health Service, New Delhi

D. C. HALL

Rapporteur and Regional Nursing Advisor, World Health Organization, New Delhi

THE committee considered that preparation for nurses at post-basic level should be approached from two angles: (*a*) nurses qualified from hospital schools, and (*b*) nurses taking a B.Sc. degree basic-course in nursing. Hitherto, further education for nurses qualified from the hospital school has been given at the certificate level without any association with a university. The committee feels that the time has come for such nurses to have the opportunity for further professional and general education. This programme should lead to a bachelor's degree and, along with preparation in humanities and sciences, develop professional competence in any one of the following fields: 1. Medical-Surgical Nursing; 2. Maternal and Child Health Nursing; 3. Public Health Nursing; 4. Psychiatric Nursing; and 5. Teaching and Administration.

Specialisation in the various special fields of clinical and public health nursing should be obtained by training and experience in the particular field following a bachelor's degree. This could form a part of the requirements for a master's degree or, if desired, lead to a postgraduate diploma.

The group did not make any particular recommendations for the m ster's degree programme, as only one programme has been established so far, but pointed out the value of internal assessment and grading of day-to-day work, both of which are desirable for the student to know her own progress as well to get credit for her efforts.

Universities offering a postgraduate degree in nursing were urged to consider establishing a faculty of nursing with the appropriate status and responsibility.

The group considered it desirable that nurses should have an idea of research. In the initial stage they may collect data for research. At a more advanced level, they could participate actively in research programmes and, after adequate preparation, become initiators of research. Education in research methodology should be an invariable part of the course for a postgraduate degree.

In all courses constant attention should be given to maintaining the quality of learning, experience, and ensuring that university courses for nurses at all times compare favourably with programmes in other disciplines.

GENERAL REPORT ON POSTGRADUATE EDUCATION IN CLINICAL SCIENCES

DR. P. N. CHHUTTANI

Courses to be Offered

1. Postgraduate degree courses leading to M.D., M.S , Ph.D., etc.
2. It was considered necessary for an interim period to continue well-defined courses of training such as D.L.O , D O.M S , D T.M., D C.H., etc.

Methods of Selection and Requirements of Postgraduate Students

Selection of postgraduate should be based primarily on the academic background of the candidates as well as on adequate interviews. If after a period of observation it is found that the trainee is not suitable for postgraduate education he should be advised to take some other course or enter some other field. If the selection for training is made after students have completed the compulsory period of rotating internship or housephysicianship, it should be possible to come to a firm opinion about their suitability after a period of one year of residentship.

The requirement for training as a postgraduate should be at least a year of rotating internship (compulsory house physicianship) followed by a year of post-registration house-physicianship. For training in neurology, gastroenterology, cardiology, chest diseases, and thoracic surgery the trainee should have already passed his M.D. or M S. examination.

Duration and Contents of Course

It was unanimously agreed that the present three-year period is insufficient and that it should be extended to four years taking registration as the baseline. The contents of the course, in brief, should not only be regular bed-side training but should also include clinical pathological conferences, journal clubs, case conferences, statistical meetings, radiological conferences, symposia, and seminars. Didactic lectures are useful only when they were well prepared and rehearsed.

Methods of Training

Inservice training and assumption of graded but increasing responsibilities was regarded by everyone as the best form of training for a postgraduate.

It was strongly recommended that all postgraduates be resident in the campus of the hospital. As there are not enough posts for inservice training for everyone in many institutions, the present system of having postgraduates working on stipends or on their own may be allowed to continue for a brief period.

The question of training in rural areas was also discussed at length but there was considerable difference of opinion on this subject. It was, however, generally felt that

only those institutions which have adequate arrangements in the field should take up the practice of training postgraduates in rural areas.

The question of giving teaching experience to postgraduates was also discussed and everyone favoured this facility being provided. Teaching experience however, was not synonymous with teaching of undergraduates only.

Experimental Departments based on good laboratories were recommended to be created. Such departments should be used actively by all postgraduate training programmes. Flexibility of curricula was regarded desirable.

Teaching of Basic Sciences

Teaching of pathology and other basic sciences to clinical postgraduates was regarded important but it should be made clear that the aim of training is a scientifically oriented clinician and not a clinical scientist. Therefore the teaching of these basic sciences should form an integral part of clinical training and not given as an isolated attachment in a basic science department.

Thesis or Dissertation

There was considerable difference of opinion regarding desirability of a thesis being maintained as an essential part of postgraduate training and examination. In spite of the drawbacks of the time-consuming nature of the work it was still considered advisable to continue the thesis as a part of training and assessment. The quality of the thesis should be improved. The question of the thesis being submitted after the formal examination was also discussed. Whether the thesis should count towards the examination assessment itself, led to elaborate discussion and it was generally agreed that this should be so. Detailed recommendations about what kind of thesis should be the objective have been made by various subcommittees but, generally speaking, everyone was of the opinion that the stress should be on accuracy of observation, scientific approach and good methodology.

V

GENERAL LECTURES

MEDICAL EDUCATION IN CANADA

DR. J. WENDELL MACLEOD

Secretary, Canadian Medical Colloge, Canada

IT is a great pleasure for me to be with you tonight and I would congratulate you on your valour in coming in from the lovely evening for what looks like a lecture. This space on the programme originally was listed as entertainment and whether I can blend into the real entertainment that follows I don't know : perhaps it would be as well if you would take many of my remarks in a somewhat light vein because they have been prepared, perhaps that's not the right word, quite hastily. I received your kind invitation to appear before you on my arrival here on Thursday, but we were engaged in so many interesting and of course very important activities on Thursday and Friday that I was sure that I would have a good chance to prepare during the weekend. However, my physical and spiritual adviser, Dr. Van Zile Hyde with whom I travel whenever I can, commanded me to leave the city and go to the shrines at Agra and Fatehpur Sikri and that is where I spent 48 hours instead of preparing a lecture for you. So if I stumble over any notes, as I have some trouble reading my writing glancing at it now, I hope you will be tolerant. I propose to make a few general comments on Canadian medicine and on the pattern of Canadian Medical Colleges of which I am the Secretary. This means that I am the servant of the twelve Deans of Medicine and, if you think it is easy to interpret their desires at all times, I can assure you it isn't. So I frequently pursue my own course until I am checked and that happens quite often also. Then I would like to close with some remarks on the Third World Conference on Medical Education that is to be held in Delhi in 1966.

Canada has 20 million people now. We are matching such countries as Yugoslavia in our population. We have about 22,000 doctors, which is a luxurious number for most parts of the world. That gives a ratio of one doctor to 860 people, or expressed in a more useful way, around 166 doctors per lakh of people. We have had since 1961 a World Commission on Health Services established by our Federal Government, which turned in a report, Volume I in June, and Volume 2, I think, appeared since I left Canada last week. This report incidentally has made radical recommendations for coverage of the entire country by medical care insurance arrangements. It is not different from the hospital insurance that covers every Canadian citizen. The medical arrangement proposed would be contributory; everyone will pay a small premium. The bulk of it will come out of the country's general revenue and the advantages of this are that it introduces flexibility so that, when the economic cycle goes in a favouable direction, more of the country's revenue may be diverted towards health, because it is considered to be a priority goal.

and all the more embarrassing because birth rates in relation to death rates all over the world are moving along alarmingly. Canada in 1981, one of the census years, will have 30 million people if the annual emigration from the country matches immigration. If, on the other hand, we have a net annual immigration of 50,000 people a year, the population would be 35 million in 1981. It is considered by the World Commission that it would be foolhardy to expect to develop any improvement of the doctor-population ratio.

As a matter of fact, it is very hard to say how many doctors a country should have. We are always conscious of our large neighbour to the south of us and our large neighbour to the north of us is the same one as you have, Russia, and we are beginning to develop much more interest these years in Russian medical experience. But we are constantly involved in trends in the United States and generally we feel that we are part of the North American economy. North American is a euphemism because we always forget about Mexico, a country of 40 million people which has a quite different economy and social structure, but from which there is a great deal to learn too. In the United States there are about 188 doctors per lakh of people in the country as a whole. But in the large States, such as California, it is in the order of 175 per lakh of people. In New York City and other large metropolitan areas where there are medical schools and a concentration of doctors there may be over 200 doctors per lakh of people. Well it appears that no one of these places feels that it has too many doctors and this has induced one of my friends to propose a new variant of Parkinson's Law, to the effect that in an affluent society, if doctors had dribbled in at a constant and increasing rate, all of these new doctors would be assimilated, they would soon all be at work and in due course they all would be regarded as essential. This process would go on until every citizen had a doctor of his own. This has been predicted also for the beds. If there are unlimited financial resources, the community is never satisfied with the number of hospital beds that can be provided. Perhaps not until there is a bed for every citizen and he is in the hospital bed all the time.

Well, our proposal to maintain the present doctor-population ratio has to be considered in connection with the fact that over the last fifteen years one-third of all the new doctors registered in the ten provinces of Canada has had medical education outside of our country. In other words, we have been depending upon the activities of the universities around the world. We feel uneasy about that on two scores, one as an occasional twinge of conscience, but conscience is always a hard thing to appraise; we worry a little because this supply of doctors may decline. Since many of the immigrant physicians to Canada come from countries which already have much greater need of physicians, we hope we he getting along with fewer from abroad. So the projections made by the World Commission have been predicted on a net immigration of doctors at 400 a year. During the last few years it has been between 400 and 600. Then from 1971, 350 doctors a year are predicted and, by 1981, 250 doctors a year. I don't believe those are very reliable predictions. However, a calculation induces us to believe that we must double the output of medical schools by 1978 or 1980. And so there is a prospect of four or five medical schools being built in the next ten years. Incidentally when I say 'medical school', it is just a form of speech, and we often call medical colleges 'medical schools'. All of our medical colleges are faculties in universities. The World Commission's report argued for an institute of health studies to be established, one that could look at all the activities in

the health field and be concerned with the supply of all health personnel. This is under study now by the Federal Government's Department of National Health and Welfare and, what they will think of it, I don't know. The hope was that some such neutral body might appraise even operations of the Government in the health field. For example, if the Government establishes a countrywide medical care insurance scheme, who should appraise its efficiency? It is very hard for me to appraise my own activities, or for you to appraise yours. It is necessary to have an outside body do it.

Someone did an account in our Medical Research Council office a few months ago which showed that the number of Canadians leaving Canadian faculties and going to American faculties of medicine was actually exceeded by the number of Canadians returning from medical school appointments to Canadian faculty appointments. Unfortunately, the Medical Research Council, which is expected to be very sophisticated in research design, did not go to the trouble in finding out in what fields these people worked nor what their academic grant had been, and just from my own acquaintance I would think that we tend to lose some of the geniuses in the very junior grades, and get back some of our Canadians who do not qualify for the advancement in the American institutions. One of the research projects of our Association is to make a study of the supply of teachers for our faculties, starting off with Medical Science Departments. My associate, David Fish, who trained in Edmonton, Alberta, and the London School of Economics, has developed a questionnaire for all the Master's and Ph D. graduates of the Medical Science Department from 1946 on, and the questionnaire returns are beginning to arrive at the office. From these we will learn what has happened to the people, what their career moves have been and we hope to follow the group that went to the United States, whether they returned or not. This possibly has some relevance to India.

We have assumed that the move was entirely due to the larger salaries in our much richer neighbour country. It has become customary just in the past year or two to say 'no, it isn't the salary, it is because of much better facilities for research' or 'for the pursuit of studies.' David Fisher and I, putting together gossip under the counter, are quite sure that there are some other factors that may be very important. Every now and again we meet a Canadian who says, 'Why should I go back to that department where I couldn't raise my voice in argument, where the atmosphere was authoritarian? When I got into one of those large departments of Wisconsin and Pennsylvania and many other universities, a man was treated according to the merit of his argument or his viewpoint. If you delivered the goods, you were accepted.' Also the intellectual ferment in some of the Western universities is a very fine thing. Canadians say the same thing when they go to the British universities and to Scandinavia and sometimes on the continent. In other words we have probably had blind spots about some of our shortcomings that have nothing whatever to do with salary and research equipment. If you lose some of your brightest people in every generation, then there is the sedimenting of the less brilliant material to the senior posts.

We have also become more conscious in our discussion of what we are doing to other countries. We are actually gaining more academic talent from outside Canada than we are losing and we have been sometimes rather slow to recognise the merits in a man or a woman, whose language is different, whose appearance is different, whose culture is different. Some of

our very strong academicians now are Europeans, or Asians who were screened by American universities, who had to leave the country because of the visa regulations and in all those instances when they come to Canada we have a chance to win their loyalty for a much longer period. Sometimes, however, they do go back to the States when the regulations permit.

Our first and major medical colleges in Canada are about the same age as yours. The three or four larger ones were started little before 100 years ago. We now have twelve which stretch from the Atlantic Ocean to the Pacific Ocean. Two of our Universities are French-speaking and one of them, the University of Ottawa, is bilingual.

I might say at this moment that we are having a very interesting time in Canada. The Madras people would be interested because we are coping with a great renaissance on the part of French-Canadian citizens. About 30 per cent of Canadians speak French in their homes, and the Anglo-Saxons have tended to assume that this group of people who were largely wood-cutters and free traders would take on English speech when they became smart enough to do it. But you know the whole French group are undergoing a tremendous burst of energy and imagination. Montreal now either vies with or beats Toronto in its music and its plays, and in the publication of literature. This ferment is touching medicine, and at the meeting of French language physicians in Montreal in November, they had a thousand doctors attending scientific sessions for full five days. They had on one of the afternoons a three-hour session on family planning. For this to happen in a completely Roman Catholic French-speaking community is quite interesting. It had never happened before, of course it hadn't happened in any of the English-speaking societies either. But the French are looking widely at the problems that face them and I think if there is one thing that will prevent us from being the Sister State of the Union, it will be the fact that more and more Canadians believe in something other than the melting pot. We call it di-culturalism or poly-culturalism because we recognise that both the Anglo-Saxon and French cultures should be encouraged. We should do the same with our very large Slavic and Germanic poulations too. Well this is something to gossip about much later.

Our medical school classes vary from 50 to 150. And we have learnt one lesson in connection with this. When I was the Dean, I joined with the others in saying we had to keep medical classes small because this was the only way of preserving the quality of medical education. And foolishly we used some arbitrary number. A class of 75 we thought was perhaps a nice convenient size. We, the University of Toronto, which is an outstanding university and its medical faculty is a strong one, has increased its class number from 125 to 150 this year, and a few months ago, the University announced that it was going to build a new building and would have a larger faculty, and would take in 250 students. So this is going to be very embarrassing to our trade unionists and medical educationists because we have been talking in terms of a formula that we couldn't substantiate. Everything depends, of course, on how the teachers relate themselves to the students. The Toronto people are of course able to point to Michigan University which is taking in quite a large number too.

Our pattern is a mixture of British and Canadian in that the four interior medical schools have virtually, for most of the students, a six-year course. Two years of Arts come under the

An interesting question to Canadians now should be: Why is it that after 1910 certain things happened in the clinical departments of the American universities that did not happen for twenty or thirty years or forty years in the Canadian universities? Within a year of Flexner's reporting, a number of the American medical schools had begun to consider how to place the clinical departments on a university basis. And in the following ten years a considerable number of old ones were converted into a university basis which meant full teachers and clinical departments with research labs related to the teaching wards and facilities for research for the teachers and students. Now, in Canada, the first step in this direction was not taken until 1919 just at the end of the war when in Toronto a professorship of medicine was set up. It was the first full-time chair in the clinical department in the British Empire. A few years later, at McGill, Dr. Meakins came from the Chair of Therapeutics of Edinburgh to establish a university clinic at the Royal Victoria Hospital, and he likewise developed a good research group from which a number of splendid scholars have emerged. But this beginning was not followed by an extension of the arrangements even within the same medical schools or even in the same departments. And, it wasn't until after World War II that full-time posts in clinical departments in Canada began to get going. Why was this? We don't know. We hope that some students of history will do a little research on this thing Such things as this, however, may have played a part. One is the economic difference between the two countries. Another is the fact that we became involved in two World Wars about two years before our sister nation Another was the fact that we had many close ties with British medical traditions. As soon as the British got going, they established, I think, something like fifty full-time clinical posts in the space of a five-year period. In 1911, Sir William Osler, who was a Canadian, came from McGill, and went to Philadelphia. went to Hopkins as a first professor of medicine and then to Oxford as research professor of medicine, wrote from Oxford to the President of John Hopkins and said that he hoped that Hopkins would not go for this full-time teaching post in the professorship in medicine. This later was given wide publicity in Canada. It is just possible that was one of the straws that helped delay our movement.

Now what about this movement in medical education, movement of experimentation and vital new life that many people think is as significant as the ferment of the German universities in the second half of the last century. We see this movement in its crystal clear form in a number of the American medical schools. It started with the Hopkins development and perhaps it came out most clearly around 1950 in the new development at Western Reserve University in Cleveland. Many Canadians went to Western Reserve and to several other schools that follow the so-called Western Reserve Pattern, and they looked at it and saw activities that had to do with the correlation clinics that integrated teaching, multi-disciplinary laboratories and some other mechanical devices. And they also noted that there were about three teachers including research fellows for students at that university. So they said, 'Well, this has nothing to do with our Canadian scene. We will never have as many teachers.' With a great sign of relief, they found that they don't have to do more thinking about it. But you know the kernel of the Western Reserve movement and it has not been confined by any means to that university. I think it is really a matter of taking a very clear and honest look at the job of a medical school.

and the Royal College was asked to do it. And it took it, I think, quite fairly as a duty. They saw that it was best equipped to do it. So, begining around 1945 or 1946, examinations for certification in each of the specialities were held as well as the fellowship examinations. The period of training was about a year or shorter. It is now five years' training for fellowship after the rotating internship for the certification examination.

One problem has been that only about forty per cent of candidates were getting through the fellowship examinations But, in the case of certification examinations, about eighty per cent were getting through. This gave rise to some alarm because it looked as though, as the years went by, there would be thousands and thousands of specialists in Canada who would be outside of the Royal College. They were not fellows. And we had meetings after meetings over the last ten years on this matter. It isn't solved as yet. But I think the trend is toward a single standard of training and a single examination standard. This is probably not feasible in the opinion of some of us because the purpose of fellowship originally in Canada as in the other Royal Colleges was to establish a hall-mark of academic attainment. In the case of the certification it was to guarantee the public that a doctor was a competent specialist in that field, and it is quite clear that in some of our speciality fields we would never have had specialists if we had depended upon fellowship examinations alone. Our Royal College functions include four stages in this connection: scrutiny of the credentials of the candidates; accrediation of the training programmes which are fixed for all of the specialitie and are of the same duration for all of the specialities, which is a bit of a conundrum if you think about it pedagogically; the approval of hospitals for postgraduate training (at the beginning we approved many hospitals that didn't merit it). I think it is quite clear that the modern hospital now dealing with a wide variety of problems has to have full-time 24 hours' coverage and needs something along the lines of an advanced British Registrar. This is what hospitals will have to pay, for a man getting good salary will work for several years perhaps. The Royal College is tending now to rely more and more on university affiliations. It is found that the medical faculty has the most neutral opinion of what is good or what is bad in training standards. Our major problem lies in the fourth of these steps—the examinations. I have mentioned the high mortality, and at present both the Royal College and Medical Council of Canada are looking into a complete revision of their examination procedures.

I would like to say just a little bit about the thesis. As an educational instrument, should we have the thesis? We have asked this ourselves very often. Our experience with the thesis has been limited to three main kinds of experiences. The first is the scholar with the Ph.D. in physics or physiology who enters the study of medicine. And his thesis has been based on a real experience in research approved by the graduate faculty of the university. At least twice in the course of its preparation, his plan is scrutinised at a meeting of the supervisory committee which is usually inter-departmental. He has had continuous contacts with his professorial supervisory for a minimum of two years and in fifty per cent of cases the Canadian Ph.D takes more than five years to attain. A completed thesis is worth publishing in the form of one or more papers in the scientific journals. Well, that is one kind. It would include a few medical graduates who have taken Ph.D. work in preparation for a scientific career. In either case, the only criticisms are that

sometimes the whole process is too rigorous and sometimes it is too narrow and we occasionally encounter, for example, a physiologist who knows a great deal about regulation but is not very scholarly in his understanding of neurophysiology. But in the main the Ph.D is an admirable yardstick for measuring scientific discipline and potential. The second one with which we have experience is the Master's degree which may share many of the characteristics of the Ph.D. It includes some mere mediocre students who have been rejected at the medical schools and who go into graduate studies in the hope of improving their acceptability for admission to medicine. This is often patently a waste of time. The same students would do much better putting in work at a broader level. The third group is the graduates of European universities who have written theses for undergraduate degrees or later for the M.D. But we have a great doubt about the value of the thesis to the majority. Too often it has meant spending many hours accumulating uncritically a raft of book knowledge which is then bound, sometimes at considerable expense to the student, and becomes lost amongst hundreds of similar theses piled on the shelves in the offices of the Deans and Department Heads. I have seen them in several countries of the world. At the same time such students often lack the most rudimentary discipline in practical clinical methods and I think the same problem applies to the graduate or postgraduate training in the residency. I think in Canada we are too pragmatic and would do better if we had more deliberate expression of studied opinion in a dissertation that would not go on to a shelf but would be the presentation of a subject at a staff meeting. This opportunity turns up regularly. This we would think is the best way to develop that aspect of its development. It is still an open question, however.

I think I had better say just this about the Association of the Canadian Medical Colleges. It was once the Deans' Club when it was formed in 1943 to meet some war-time problems. But now since 1962 we have a secretariat and, in addition to the studies that I have mentioned, we are carrying out one on the cost of medical education to the university and the cost of the educational activities to the teaching hospital. This is carried out in collaboration with the Canadian Association of the University Business Officers, and with a group of hospital administrators. We are also going to have to study our teaching of preventive medicine. Preventive medicine in Canada is our weakest medical faculty field. The professors are worried about it because when they look at the ascending line of development in the other departments, which is measured by budget or number of faculties, or production of research or published papers, preventive medicine is almost standing still. We are going to have a conference on it and we should probably attempt a survey similar to that conducted recently in the United States by Shepart and Roonie and published as a supplement to the Millbank Memorial Fund Quarterly in October. I think this is only one of the lessons that I would put down for mention because I think it is so important. We have as President Dr. Jack F. McQuarry, Dean of Medicine at the University of British Columbia, whom some of you may recall as a Colombo Plan lecturer with Dr. Penfield and Dr. Rascheur of Ottawa a few years ago. Dr. McQuarry has a profound conviction that it is important for people who have different slants on the topic to get around the table and talk it over. And so when he became the president of our Association, he established the policy of inviting to every one of our

executive council meetings, a representative from the Government's Department of Health and Welfare, Dr. K.C. Sharan, who visited India some years ago along with the General Secretary of the Canadian Medical Association. This was objected to first by some of our Deans who felt that they were being mixed up a little bit too much with the market place. But, believe me, to have education problems understood by the leaders in the medical profession is the most important thing to aim at. We also have the Royal College usually represented by the President and sometimes by one of the Deans, and we invite the President of the Medical Research Council whenever our agenda has material on it that would interest him. That is one tactic that I think may be worth while.

One should talk about these things only with the greatest of humility because it is hardly ever possible to transpose one way of doing things in another country. I had an occasion to visit Colombia in South America not long ago, and as Dr. Van Zile Hyde mentioned in the lecture the other day at the Institute in Delhi, that Association because of its special situation there is able to do many things that will be difficult to achieve elsewhere, because some of its members have been Ministers of Education or Ministers of Health in the past. They have been able to put through legislation that gives them extraordinary power, and I think, in the public interest, because of the setting there. They inspect the hospitals for internship, they inspect the hospitals for residency training in the specialty. They set the examinations for specialities. We will follow that with a great deal of interest.

In closing, may I make the simplest kind of statement about the World Conference to be held here in 1966. The title is 'Medical Education, Factors in the Socio-economic Development,' and the relevance of that title is quite apparent if one considers the problems of medical education in many parts of the world. The conference will be held under the auspices of the World Medical Association co-sponsored by the World Health Organization and the Pan-American Health Organization, and with the collabration of international and national organisations, associations and foundations. The host is the Indian Medical Association with the support of the Government of India and with the co-operation of the Association for the Advancement of Medical Education the Indian Academy of Medical Sciences, the Medical Council of India and the University Grants Commission and some similar agencies. The President is our distinguished Chairman this evening, and the Deputy Chairman will be Professor R. V. Sathe of Bombay. Eight Vice-Presidents are being invited to represent the various world regions. There will be 16 Indian Deputy Vice-Presidents appointed. The four major topics for seminars will be: (1) social change and scientific advancement—their relation to medical education; (2) medical education and the national culture; (3) organisation of the medical curriculum to meet the needs of the society; (4) planning new programmes in medical education. I won't deal with the committee structure that is setting up the conference. You will be hearing a great deal more about that later. But there is a clause here on membership which is of interest. This, by the way, will be a work conference rather than a conference with many speeches. It will be a little bit more like a W.H.O. Special Conference where there will be background papers for the delegates to study before they come, and there will be a few keynote speeches. Most of the conference will consist of group discussion. Each national member association, each school or college listed or eligible to be listed in the W.H.O. Directory of Medical Colleges,

and each ministry concerned with the theme of the conference, that would be Education and Health, of the Member Nation of the United Nations or its specialised agencies, will be invited to designate two individuals to serve as seminar participants. There will be three types of membership in the conference: the seminar participants as mentioned will be individuals invited to speak and individuals representing National Medical Associations, Ministers of Health and Education and Medical Colleges; the general participants will be physicians and other interested individuals from countries other than India. General participants may attend all plenary sessions of the conference and the seminar sessions held in the auditorium. They may not attend the other seminar sessions and the discussion sessions. At the seminar sessions, the general participants may send written questions to the Chairman, but not participate in general discussions. Observer participants will be physicians and other interested individuals resident in India, and they have the same privileges as general participants.

WHITHER EXAMINATIONS?

Dr. John P. Hubbard

Executive Director, National Board of Medical Examiners, Philadelphia, U.S.A.

MR. PRESIDENT, MEMBERS OF THE ASSOCIATION AND FELLOW-GUESTS TO THIS MOST INTERESTING CONFERENCE:

If I had needed a demonstration of your interest in examination, I assure you, you gave it to me in full measure at the concluding part of your afternoon conference. During the past year or more, the Office of the National Board of Medical Examiners has been privileged to welcome, first, Dr. Reddy, Director of your Association, then, some months later, your eminent and distinguished Pathologist, Dr. V. Ramalingaswamy, and, shortly thereafter, Dr. Rao, soon to become your Director-General of Health Services. Each of these representatives of your medical profession spoke very earnestly of the interest that you have in the problem of examinations and the problem that you share with all of the nations in determining the most effective method of assuring a high quality of medical education and medical care for your people. In particular, they spoke of your objective, discussed at length in this conference, to develop your own standards for advanced professional competence, rather than continuing the custom of having your graduates travelling abroad to collect additional letters after their names and relying upon the examinations and qualifying systems of the Royal Colleges of England and the speciality boards of the United States.

It was very clear to me in these discussions with your distinguished colleagues that you see both the challenge and the opportunity of the task that lies before you to set up a uniform standard of postgraduate education designed for the needs of India. When, therefore, you honoured me with an invitation to attend this conference, and to participate in your deliberations, I was very pleased indeed to be able to accept your invitation. I had not, however, anticipated the further honour of being asked to address you this evening.

You have asked me to speak on the topic *Whither Examinations?* Before we can talk sensibly about where examinations are going, we should consider briefly where modern examinations have come from.

Let me take you back to a time, nearly 200 years ago, when some obstreperous colonies across the Atlantic from England were making a fuss and declaring their independence. When these colonies became the United States, this new nation had only three medical schools; there were only 400 physicians who had any formal medical education and only 200 of these held medical degrees. After independence, there was a rapid proliferation of medical schools, too many of which were more interested in the fees collected from students and in the printing of diplomas than they were in the standards of medical education. Something had to be done. What was done was typically American! Each state established its own separate examining and licensing board. This development was accompanied by two new problems. There was

no uniformity from state to state in the culture of examinations and hence in the qualification for the practice of medicine. Secondly, when a physician wanted to move from one state to another, he was required to take another set of examinations administered by the state he was entering, despite the eminence that he might have already achieved in his professional career. To alleviate these two problems that we had made for ourselves, it was proposed that a National Board be established to prepare and to administer examinations of such a high, uniform quality that those who passed these examinations could be recognised as qualified for the practice of medicine in any state without further examinations. Who should be given the responsibility for these examinations? It was thought best not to place this responsibility in the American Medical Association, the Medical Colleges or a governmental agency; rather it was decided to create an independent agency with representation from the American medical association, the Association of American Medical Colleges, the State Examining Boards and the Federal Medical Services. Thus there was born the National Board of Medical Examiners in 1915—just fifty years ago. Let me interject at this point—I must hasten back from this conference in order to start the 50th Anniversary celebrations of our National Board. I mention this to explain to you why I am unable to stay here longer, as I would wish, and accept the invitations of so many of you to see more of medical education in India.

So, the National Board of Medical Examiners was born and its first task was to determine how to develop examinations suited to fulfil its responsibilities. It will interest you to know that a Commission was appointed and sent to England to study the examinations of the Royal Colleges and the Examining Boards of England and Scotland. We have, hanging in our office at home, a prized picture of the members of this commission, standing with William Osler in his garden in England, only months before he succumbed to pneumonia. Upon returning to the United States, the Commission recommended the adoption of the three-part examination that they had observed in England. Part I—a written examination covering the basic sciences; Part II—a written examination covering the clinical sciences; and Part III—a practical clinical bedside and oral examination. This was the method of examination used by the National Board until 1950. By this time the science of testing had made great progress in the United States. Objective methods of testing and assessment have been developed by use of what has become known as 'Multiple Choice Examinations'. These have become widespread throughout our school and college system. We, at the National Board of Medical Examiners, undertook an intensive two-year study of these objective methods in order to determine if they were applicable to the assessment of medical education. We changed part of the written examination into the multiple choice form.

A careful statistical analysis of the results of this multiple choice examination in comparison with the traditional essay examination favoured the multiple choice form. It proved to be a more precise and reliable examination. We then converted other examinations to the multiple choice form and again the statistical analysis favoured the multiple choice technique. The results of this study were so convincing to us that we proceeded to convert all of our written examinations of Part I in the basic sciences and Part II in the clinical subjects into this new form of examination. A few years later we turned our attention to our Part III examination. This is the final part of the series of National Board Examinations that covers

in film libraries of the American Medical Association, the Public health Services and the Association of American Medical Colleges, but we do not find in these films useful examples for testing purposes. These are all made for teaching purposes. The purpose of a teaching film is different. It wants to point to something. Very often this is done with an arrow. There is also often a sound script along with the picture and a description, focusing upon what you are teaching about. The film for testing is very different. You want the candidate to see; you want him to see fairly in certain situations in which he must see closely, so the camera is brought close to the patient. We have discarded the idea of getting from the large mass of teaching films that are available in the United States films suitable for our purpose. What we do now is to select a patient very carefully with an objective to what we wish to demonstrate, then we have the services of an expert camera crew that come into the hospital, set up shop there and the pictures are taken. Now, as the candidate sees the picture, he hears no sound and he is instructed ahead of time to watch very carefully and he is told that he will be asked questions about the patient as soon as the picture is finished.

We have now been using these films for about three years and we have learned through experience some of the things to do and some of the things not to do, and, as we are now using them, they have become a part and we think a valuable part of our assessment of clinical competence.

It is a considerable logistical problem to undertake this kind of examination in that we have copies of the film made, sent out around the country, and the candidates in some sixty centres throughout the united States will be seeing films such as this on the next examination date, which happens to be March 3rd.

We give the candidate a good long time in the movie to observe as he would observe a patient. This part of our examination really is just to test this attribute of the candidate, in particular his power of observation. You will agree that the power of observation is one of the most important attributes of the experienced physician. We feel that we can measure that attribute through this manner of testing.

Then we give the candidate considerable time to note the pattern of the respiration. Sometimes with a cardiac patient, we show the apex, impulse, and one can detect whether or not the rate is rapid, whether or not the rhythm is regular and we will show such things as the engorgement in the veins of the neck. If the candidate sees what is there before him to see, he will have no difficulty in answering that particular question.

We have tried motion pictures with sound in order to obtain an assessment of the competence of the candidate in taking a history. But we have not used this very much; we find it difficult to handle this. After the film has been shown you ask questions about the history, and really about all you are testing is whether or not the candidate remembered what the doctor said to the patient So most of our films are now silent. The candidate is asked not only to observe certain signs, but what conclusions he drew from them. Most of our film sequences run about seven minutes. We do not want to make them much longer than this We want to give the candidate a chance to answer the quest ons in the test booklet immediately after he has seen the demonstration on the screen. Neurological signs are, in a sense, one of the best types of situation that can be demonstrated by the motion picture,

eliciting reflexes, behaviour of the patient, the gait, the Romberg-Hoffmann sign or something of this sort or the Babinski, Ashere sign of response—all of these neurological signs require motion and this type of neurological examination is one of the features of the examination that lends itself most readily to testing by motion picture.

We have the second section of our Part III examination which does not require motion; this we speak of as stills. Perhaps there is a picture of a patient that would be used as an example demonstrating endemic goitre, or demonstrating some characteristic, possibly congenital, *anomaly*. These things do *not require motion; they are incorporated into* the second section of what is now the Part III examination.

At this point, we have examination booklets before the candidate and we ask him to open his examination booklet and to answer the multiple choice examination questions. Time does not permit me to read all the test questions to you; there is a series of 37. Questions on the observation: What did he see? Did he see what was there before him to see? Then, secondly, we ask him for conclusions based upon his observations. As, for example, there is evidence of paresis of the ocular-motor nerve, trochlear nerve, the abducens nerve, correct response from none of these. And then we ask him to *make a diagnosis. We give him* a list of some dozen diagnoses and ask him to choose amongst them. Then perhaps we will give him additional information on the printed page. And we ask, "What do you think of the diagnosis?" So, this really is a sketch of our film procedure.

Let me pass on to the next portion of our Part III examination, which is designed for a somewhat different purpose, to determine the candidates' ability to resolve the problems presented by patients and to manage these correctly and appropriately. We try to *stimulate* the situation where a house-officer may be called to see a sick patient who perhaps is in the emergency room, just brought in. Here is a problem. He has to study the problem. Let us assume that there is no senior physician to tell him what to do. He has got to make the decision. Things happen as a result of what he does, and then a new problem is created. He may have ordered a laboratory test; he gets the results of the laboratory test and then with additional information he has a new problem. This is the situation that we have tried to stimulate in a new testing technique; because of its resemblance to programmed teaching we have designated this as Programmed Testing. It is based really upon a sequential unfolding of the problem just as it might happen in the admitting room, in the emergency ward, hospital clinic, or probably the doctor's own office. This is a new, rather unfamiliar, type of procedure *and we wish the candidate to be totally familiar with this before he actually takes the test,* and so we give him a sample problem that is over-simplified so that he can get some feeling of the method before he begins the real examination.

This is printed on the back of the test booklet and the candidate is told to practice with this to become familiar with the method before he goes on to the test itself. Here, you are told of the situation in the emergency room and go to see a patient; he has Kussmaul breathing, his eye balls are soft, his B/P is a 100/70, there is no evidence of trauma. What would you do? We wanted to make this just as clear-cut as we could that the patient was in diabetic coma. And then give the candidate a series of some half a dozen or dozen choices of thing that he can do. The next slide shows only three* of the choices that we are offering him her

Actually, the series goes on to about eight here. What would he do? Would he order a gastric lavage and send the gastric contents to the toxicology laboratory; in other words, does he think this is a patient acutely toxic? Poison perhaps. Would he determine the blood glucose concentration? Of course, that is really what he would want to do Suppose again he were asked to examine and he said: he is a comatose patient—I am going to do a lumbar puncture. We give him a choice to do these things. He is instructed to go over here—actually on the examination book there is a block of ink which he is instructed to erase if he wants to do that thing, make that action as the choice. So, select the choice determine the blood glucose concentration. He then takes the eraser which we provide, erases this block and then in the next lantern slide there is revealed under the erasure the information that he would get if he sends this blood specimen to the laboratory. Suppose he wanted to do a lumbar puncture. There is not a senior physician there telling him no, don't do a lumbar puncture. So, he does a lumbar puncture. And he would erase this block and he would find there the blood-pressure, spinal fluid pressures normal. He would get the clue that he was on the wrong track and he had better get back on the right track.

Now this examination is scored by giving a plus score to the correct response and giving a negative score for a wrong response, or for not doing the right thing. I am sure that you will agree that failure to do the right thing can be just as bad as doing the wrong thing.

One of tha criticisms that you often hear made of multiple choice examinations is that they are picking away at isolated pieces of information and they do not do what you as an examiner want to do, to determine whether or not this individual really knows how to solva a problem. I will answer that question by reading you just one question that happens to be out of the physiology text-book. I hold in my hands here, National Board Medical Examination, consisting of 17 test booklets. It covers five testing days. The physiology examination was a two-hour examination and, if you think it does not lend itself to problem-solving, let me read the following:

"Mean pulmonary artery pressure in a 25 year old man was 15 mm. of mercury. After the right pulmonary artery was occluded by a balloon catheter, pulmonary artery pressure rose to 30 mm. of mercury; before and after occlusion, left arterial pressure was 0 mm. of mercury, the cardiac output was 5 litres per minute. Assume the blood flow was in the right and left lungs before occlusion." And then four or five questions about the situation, the first of which is: "Following occlusion of the right pulmonary artery, pulmonary vascular resistance in the left lung would have been: (1) Half of its value before occlusion (2) $\frac{3}{4}$ of its value before occlusion (3) the same as its value before occlusion." And so on.

I do not think I should go on with this particular problem to impress upon you the fact that this is a problem-solving exercise. In the clinical field, we reproduce skull roentgenograms for differential diagnosis.

Here then are some of the techniques we use for objective, impartial, precise and reliable assessments of medical knowledge and clinical competence.

Quite obviously I have had time to touch on only the highlights. If you wish to study these testing methods in more detail, or to see copies of our examinations, such as these, arrangements might be made for you to do so. Or, if you should wish to know how your

VI

CONCLUDING SESSION

REPORT OF THE CONFERENCE ON POSTGRADUATE MEDICAL EDUCATION IN INDIA

V. RAMALINGASWAMI

(*General Rapporteur of the Conference*)

RAPPORT means harmony, *porteur* means to convey, but a rapporteur is not a harmonizer; he is simply a reporter. My definition of rapporteur, especially a general rapporteur, is one who is given the impossible task of summarising all that has been said in these three days—150 papers, thousands of words of discussion. The area covered is so vast, and our sectional chairmen and rapporteurs, and the sub-committee chairmen and their rapporteurs, have done such a splendid job acquainting you with what has happened in their respective areas that my reporting can at best be sketchy, personal, and perhaps even biased.

To my way of thinking, the *raison de etre* of this conference is the conviction amongst us that further education is needed in whatever branch a physician chooses to adopt, be it general practice, specialist practice, teaching or research. We have undoubtedly repeated ourselves at different times, and might even have indulged in pontificial sermonising. That is inevitably so in every medical education conference. Perhaps we can take solace from the *Autocrat of the Breakfast Table* who says, "a thought may be original although you uttered it a hundred times. It has come to you over a new route, by a new and express train of associations."

THE PRESENT SCENE

Much seems to have gone wrong with postgraduate medical education in India today. We have been free and frank and, perhaps, sometimes utterly frank in acknowledging this. We have criticised ourselves about the lack of intellectual content in our postgraduate education. We have said that we do not give enough practical bias in the training of our physicians. We have been feeling that the duration of training has been somewhat short. We are acutely aware of some of our glaring deficiencies in producing teachers of quality. Some of you will remember how this has been a recurring theme at our previous conferences. We are not at all satisfied with the quality and motivation of the average type of postgraduate student that comes to us. We have several pangs of conscience, outwardly expressed or inwardly felt, about methods of assessment. We have been reminded by Dr. Alex Steigman in his working paper of the Flexnerian dictum that postgraduate education is not a repair shop. It is a continuation of something begun at the undergraduate level as a life-time study. I think Dr. Jacob Chandy perhaps means this when he says in his working paper that this is a mile-stone in the education of a physician, hopefully not a mill-stone!

THE TEACHER'S TESTAMENT OF FAITH

The keystone of the arch of higher learning is the teacher, as Dr. Viswanathan put it. This subject received considerable attention on the first day of our discussion. The teacher's

opinion from the clinical and pathology groups that we should prolong the duration of training for a postgraduate student by at least one year. The recommended pattern runs as follows:

> 4½ years of undergraduate study, one year of rotating compulsory internship or house-physicianship, one year of post-registration house-physicianship, and three years of postgraduate study in the speciality. In the basic sciences too, in one way, this has been achieved in the sense that three years of formal training in a department is considered necessary, the only difference being that they do not insist on a year of post-registration house-physicianship. Incidentally, this double-barrelled term, 'house-physicianship,' arouses pleasant memories of two very delightful contemporary works—*The Doctor in the House*, and *The Doctor at Sea*. We all fervently hope that this increase in the duration of training will be matched by increasing the learning opportunities for students. Otherwise, this recommendation will be deprived of its significance.

ASSESSMENT AND NATIONAL EXAMINATION

The stimulating address of Dr. John Hubbard has, as our President remarked, opened a new vista and many of us have been moved to re-examine our assessment system and a cautious approach has been put forward that we should consider the increasing use of objective methods of examination in our assessment programme. The Biochemistry Group has even gone a step further and according to them it is possible to test the teaching skill of a postgraduate student by giving him a suitable teaching exercise. Dr. Kasliwal was given the task of piloting the ship of National Examinations. He told us that the function of National Examinations is to explore knowledge over a wide field, that uniformity and not rigidity, standards and not standardisation, should be its objectives. I think I am right in saying that there is a very remarkable measure of agreement on the need for National Examinations.

testament of faith as laid down by our University Education Commission perhaps has nothing to parallel it and is equally applicable to all that we said about teachers in medicine. This testament is in three parts: "(1) translation of the intellectual and ethical heritage of humanity; (2) enrichment of this heritage and extension of the boundaries of knowledge; and (3) development of personality." We are told that teachers are products of Nature. If they are born, how have they been born? asks Dr. Small of Edinburgh. If they are not born, let them be born, says Dr. Dakshinamurty of Andhra. The heart of the matter is that we have moved a long way in recent times from the concept that a good teacher is nothing but a product of genetic make-up. Educational science tells us that both the art of teaching and the techniques of teaching can be cultivated, and Dr. Rajapurkar and Dr. Sarbadhikari addressed us on the first day on this problem—educating educators in the science of education. We have also had our lighter moments in discussing this. "Those who can, do, those who cannot, teach," is a Shavian aphorism, I guess, which Dr. Small has told us. Dr. Sarbadhikari's presentation had one note in it which particularly appeals to my background as a pathologist. The postgraduate student in clinical sciences is likened to a toti-potential cell. The three potentialities he mentions are the doctor, the humanist and the artist.

HOW MUCH RESEARCH

Apparently, Dr. Chatterjee of Calcutta who, incidentally, has forty years of teaching experience has not been able to find a clear distinction between a thesis and a dissertation. There is much concern amongst all of us about the quality of the theses and dissertations written as partial fulfilment of postgraduate educational requirement. Dr. Basu described it in a rather telling manner by saying that many of our postgraduates when they write a thesis excell in "second-hand copywriting." There has been a considerable difference of opinion regarding this subject, but I sense the general feeling that it is a good thing to insist upon writing of a thesis or a dissertation as a formal requirement. As Dr. Wahi said, this requirement is meant to be an initiation into research to generate habits of inquiry, habits of speculation, of questioning, of penetrating doubt, of accurate observation. A significant step taken in this direction has been that the last date for the submission of a thesis or dissertation could be made more flexible than at present and that it could be submitted even after a student has qualified at the formal examination. This I am sure will help to remove the element of tension from the mind of the student, leaving him free to learn. We also want to remind ourselves of the point that Dr. Van Zile Hyde made on the first day, and subsequently reiterated by other speakers, that we should not allow this emphasis on research, thesis or dissertation, to overload the student's work and to vitiate primary attention to the subject-matter.

DURATION OF TRAINING

We have moved a considerable distance in recent months in our attitude to the duration of training for the postgraduate student. The crying need for specialists has resulted in the failure of all attempts in the past to prolong the period of training. Dr. Wig, on the first day, set the keynote to this, which had a salutory effect later on and we now have a unanimous

no less important in nursing education than in general postgraduate medical education. Nursing education is now moving towards the university, as well as to the area of public health and the rural sector, but Miss Adranvala did after all assure us that nurses will not leave the hospitals, an assurance received with much relief by the doctors.

CONCLUSION

Yet another conference is coming to a close What have we achieved? This, I know, is the constant question on the minds of all of us. In a few days you will receive an evaluation form. Some questions have been framed; you do not have to sign it if you do not wish to. And some answers are solicited of you regarding your free and frank appraisal of the way this conference has been organised and your suggestions as to how we can build upon this structure. We have embarked on a great and exciting enterprise in these three days. We have at times been Utopian. We do not legislate; we air views and we hope we take back some at least of the others' views which may exert a beneficial influence on us. There has been some intellectual and spiritual refreshment, I hope, although I use the word "spiritual refreshment" in a restricted sense only, undoubtedly in the nobler sense. We leave this conference with renewed dedication to the training of the physicians of the future.

there should be some flexibility in the available academic positions in an institution and I am reminded of the suggestion by our worthy President made to the All-India Institute of Medical Sciences in Delhi that we should have floating professorships in order that we may not have to wait for long procedures to be completed before we can offer an attractive position to a promising teacher or investigator. We have also talked about salaries, and this morning we have had a particularly interesting, if slightly heated, discussion on private practice. When does not this subject elicit a heated discussion? We have also talked about continuing education. We have been deeply concerned about the neglect of educational opportunities for general practitioners. All this and much more came under discussion.

THE TEACHING HOSPITAL

Dr. Joglekar and Dr. K. N. Rao have posed some very important problems regarding the teaching hospital. While we are expanding the opportunities for postgraduate education, they have reminded us that we ought to look very carefully into the attributes of a teaching hospital: its structure, how it should respond to the needs of education and research. Dr. Santokh Singh Anand told us how an out-patient department should be devised so that it could be a learning place. Dr. Joglekar painted a picture of the anatomist percolating into the autopsy room, surgical clinics, and radiology department. Clinical groups want to go to basic science laboratories, basic science groups want exposure to clinical challenges. We have thus accepted a two-way traffic. This certainly is in tune with the principle that Nature abhorrs one-way traffic.

Hospital Administration came in for a discussion this morning. Regional Hospital Boards and Regional Postgraduate Committees have been advocated by Dr. Rao. This is an important area where practical improvement can be brought about through the opinions of this Association.

NON-MEDICAL TEACHERS

Non medical teachers and the contribution that they can make towards teaching and research in our departments has been one of the most notable points that came up for discussion in several groups. I think we have made a truly significant advance in this field and although there is no unanimity of opinion on how many positions should be open to them, or, as Dr. Wig has asked this morning, "should you block a brilliant non-medical scientist of excellence from rising to the position of a head of a department, because he has no medical degree?" We have moved a long way from the rigid positions of the past. The problem of pattern of training for non-medical scientists has been gone into and some of the Basic Science Groups have given detailed programmes of training for non-medical scientists.

NURSING EDUCATION

The nursing profession is wanting to move away from the time-honoured hospital school training programme, the preceptorial pattern with which we are all so familiar. As Miss Adranvala said, nursing cannot fulfil its mission today entirely if it is confined within the hospital walls. Psychology, sociology, philosophy and educational principles form an important backdrop to nursing education. Faith and capacity to respond to a learning situation is

I hope that this attitude of the understudy for a good teacher will be appreciated by all of you. When I say understudy, it need not necessarily be under a good teacher in every respect. We cannot always be understudies to good teachers. But the faults the teacher makes are as good to you as valuable lessons as the good points that he tries to emphasise. And to that extent, therefore, it is good that the Assistant Professor or Lecturer sits with the Professor when he is taking a class and sees how he puts his ideas across and how he rouses the minds of students. Just as, when you are giving an oration to an assembly, you will do well to watch the response of the assembly—the glittering eyes, the smiles, the occasional claps and sometimes the snorting faces of your audience—you will learn whether you are teaching them well or not.

Dr Ramalingaswami and many others have referred to the place of libraries. I am a great believer in the utility of libraries provided they are used properly. There is no use, and I have had the misfortune to see this, to have a number of beautiful books but dust-laden, never removed, never utilised and the library hall empty. If a library is to be well used, there should be good cataloguing, good indexing, there should be people who can get you what you want when you want it, and that is the reason why, for instance, the University Grants Commission has given us the permission to utilise 15 per cent to 20 per cent of its grant to recruit the necessary library staff so that they may be in a position to get the library in proper order for its better utilisation. And here may I hope that it will be possible for you, if not on a compulsory basis, at least on a voluntary basis, to see that the postgraduates who are trained under you equip themselves with the knowledge of one or two additional foreign languages. I place particular emphasis on German and Russian which today give us much more of the pabulum of the thinking of research workers and the advanced workers in the field of medicine. I myself have tried to see that, in the University, the science postgraduates are given this opportunity.

CONCLUDING ADDRESS

Dr. A. Lakshmanaswami Mudaliar

LADIES AND GENTLEMEN:

AFTER all everything must come to an end. And this conference which has delighted many of us, which has brought us from far and near, which has helped to renew our acquaintances and make fresh acquaintances, is coming to an end. You may ask me what is my impression of this conference. Frankly, it has heen given to me to attend many many conferences, I cannot remember how many, it is not even in dozens, but more—many international conferences, many national conferences, many regional conferences on the suhject of medical education. I can say with truth, not hecause I want to flatter anybody, much less to flatter myself, that this conference will he a highlight amongst the conferences that have heen held. It is true that we had to speak on many suhjects. It is true that we had to repeat ourselves, hut there is something good in repetition also and there is something good in reminding ourselves that we are not the last word on the subject. I think all of us realise that today the suhject of medical education dominates the whole field of medical training. It is a very happy idea indeed that some of our friends conceived the possihility of an Association which will devote itself entirely to the suhject of medical education. This process of medical education is a continuing process. It goes on expanding, intensifying. invigorating and to that extent, therefore, this is a suhject which ought to attract the attention of all teachers of medicine of all grades wherever they may he.

Many subjects have heen referred to, I shall not go into all of them. One of the prominent subjects that was referred to is teacher training. Somehow or the other, it has heen my good fortune to have been a teacher for nearly forty years. And I was supposed at that time, I don't think I ean claim that reputation now, to have heen somewhat of a successful teacher from what my old students have told me. Now the question has been asked what sort of a training should a teacher get? People have the impression that the teacher training programme should be more or less what is given now in our training colleges to those who are going to teach school boys. Now, we are not going to teach school boys. That sort of training in a training institution would be far from useful. The best method of training, I think, is to be the understudy of a good teacher who knows how to express himself. If you want to be a good teacher, three things are essential. You must know your subject, you must love your subject, and you must love the art of teaching and try to improve it everyday. There can be no doubt, whatsoever, that a teacher is not born in any sense of the word. He has got to cultivate himself from time to time and with a good background, no doubt, he can acquit himself as a good teacher much easier than others can. You must have a fine voice, I won't say a melodious voice—you need not be a singer—but you can't be a good teacher if your voice is harsh, if you cannot put across your thoughts freely and if you haven't got the expression to convey what you have got to teach.

of all the possibilities of medical, surgical and specialist relief to the whole of the district. A few centres may be located as health centres but the majority of the villages can be served by teams from these centres and from the associated improved hospitals in the district to go out periodically for two days in the week, look into the public health problems as well as give medical relief. I am emboldened to say this by the remarkable experiment that has succeeded in Rajasthan in another respect, where there is a mobile operation theatre with an accessory post-operation ward being taken from village to village. This, of course, will be much more useful in such subjects as Ophthalmology, but I throw out the suggestion for what it is worth.

It seems to me that we have laid the right emphasis on Nursing Education, also on the training of paramedical personnel and more particularly of technicians. I have ventured to suggest in my address that the subject of bio-medical electronics is important and I have had discussions with the engineers who have specialised in electronics and who feel that this is a vital subject which ought to be developed in close collaboration with engineers and medical personnel. I hope the day is not distant when we can get this done and we can get our own specialised apparatus for use in our surgical theatres and for diagnostic purposes.

So far as Nursing Education is concerned, I think it will not be long before we start with the two courses of training, one for the basic degree or diploma holder, the other the specialised training that is needed for persons who have already passed the diploma and have worked in the hospitals for at least five years to get a postgraduate qualification in a speciality.

In expressing the appreciation of the Association to Dr. Coelho, Dr. K. N. Rao, and Dr. Govinda Reddy, all that I can say in the words of our own scriptures is "to work, you have the right, but not to the fruits thereof." It is for others to get the fruits. And this Association is laying the foundation for the fruits to appear at a later stage. Thank you.

this. The Royal College of Obstetricians and Gynaecologists have a diploma, a membership, and a fellowship. You will find if you closely examine that after consultations with all these bodies they went a step further and for the first time a Royal College established the principles that should guide any student being admitted to the examination, not to the diploma. They said that a person must work for so much time in an approved institution, that he must have conducted so many cases, he must have recorded observations on so many other cases. Details like that were prescribed for the examination, not only for the fellowship, but even for the membership. I do not want to dilate upon this much further, except to say that I think it is now well recognised that the diplomas given by the Royal College of Obstetricians and Gynaecologists are given the same sort of value and are looked upon with the same degree of high regard as any of the other diplomas given by the other Royal Colleges.

How are we to begin? In our country there are many associations and I feel that these associations should work together. These associations must be fundamentally a part and parcel of the organisation that will be set up for this purpose. The Indian Academy of Medical Sciences and the Association for the Advancement of Medical Education also have a part to play in the setting up of National Examinations: so have all the specialist associations. I hope and trust when this is done and the Board is set up, it will command the respect of all and will have its decisions accepted by all connected with it. I do not for a moment suggest that universities should give up their rights and, after all is said and done, if the universities conduct their degree courses properly, nothing can be more delightful than that. But still I do feel that with a view to having a standard established for the whole country, the proposal for a national diploma commends itself so long as conditions under which these national diplomas can be awarded are strictly and scientifically scrutinised, and certain general principles are laid down.

Many of us are deeply concerned about rural medical relief which baffles all attempts at solution. We are told that there are in India about 750,000 villages, and it is necessary that this population should get adequate medical relief We have tried to deal with this problem in a very limited way in the Health Survey and Planning Committee Report that was issued a little while ago. It seems to me that no uniform manner of implementing rural medical relief is possible for the whole of India. Conditions vary so much from State to State, from area to area, that just one type of rural medical relief will not serve the purpose. I have therefore been feeling recently that the best method would be to tackle the problems of rural medical relief in the context of conditions existing in a given State and these conditions differ from State to State—good roads, easy means of communication, telephone, telegraph, wireless stations, police stations and easy accessibility for the medical teams to get across when there is any emergency. Two States where these conditions are relatively better developed are Kerala and Madras. I have been recently discussing with my government that if, in each district, a small training institution for medical graduates could be established with about 400 beds, with the teaching personnel that are required for the several branches of study, and if a small number of medical men were to be admitted, say sixty, not only will the training centre be useful for giving adequate training to this number of doctors of a nature which is not possible when we admit two hundred or three hundred students, but it will also serve as a centre for diffusion

Learning in area is giving place to learning in depth. The area of medicine is expanding beyond the horizon of man's vision. The depth of medicine is unfathomable. Simultaneous learning in area as well as in depth is virtually impossible. Hence the inevitability of specialisation.

Having conceded and accepted the inexorable trend to change from area to depth in the field of medicine and medical training, one can speculate with reasonable accuracy on what we have *in store in* A.D. *2000.*

How are postgraduates in medicine going to be trained in the 21st century? In other words what are they expected to learn and how will they learn?

Even as late as the twenties of this century there were very few fields for specialisation. There were no *special courses* or *prescribed periods of study* even for *M.D.* or *M.S. Examination* was the only criterion. M.S. and F.R.C.S. could be obtained without touching a knife.. To-day the inevitable change has occurred with advances in depth of medical sciences. The depth of knowledge to be possessed by the prospective specialist in any particular branch of medicine is alarmingly considerable. The deeper the advances the narrower the speciality. Medical educationists are frantically exercised over devising ways and means to impart the knowledge in depth to the postgraduate students. Special courses of training have been made compulsory. Longer and more acceptable spoons are being devised to feed him. Inspite of violent protestations to the contrary, spoonfeeding is being resorted to, to a much greater extent than before. This is inevitable as we are in that stage of revolutionary transition when the well of knowledge is becoming narrower and deeper and, at the same time, the student has not yet acquired the appurtenances required to perceive and penetrate those depths of knowledge by himself. In the twenties neither the spoons were provided nor the facilities to learn by himself were available for the poor postgraduate. Today the *spoonfeeding facilities* by way of set courses are becoming more available than before though self-learning remains only a pleasant dream and a fervent hope of the medical educationist of today.

POSTGRADUATE MEDICAL TRAINING IN A.D. 2000 (A SPECULATIVE CONCEPT)

R. VISWANATHAN

FROM times immemorial man has been deeply interested in his future. So intense is his desire to know what will happen in later years or after life that he is inclined to consult the stars and obtain astrological predictions about his destiny.

My speculation about what will happen in A.D. 2000 regarding medical education in general and postgraduate training in particular is not based on what the stars foretell, but on the scrutiny of what happened during the last forty years. If the curve of evolution of medical education from 1924 to 1965 is extended up to A D. 2000 an idea about the future of medicine can be obtained with reasonable accuracy.

Medical training, whether undergraduate or postgraduate. has necessarily to be adjusted according to the advances made in medical sciences from time to time. Progress made in the field of public health, and in the nutritional and social status of the population as a whole, brings about radical alterations in the disease pattern. Communicable diseases like cholera, typhoid, malaria, tuberculosis, etc. will either be controlled or eradicated. In consequence there is bound to be a shift in emphasis and importance from one disease group to another in the training to be imparted to medical students.

Advances made in basic sciences are being extensively applied to medicine both for diagnosis and treatment. Visualisation of structures and organs by X-ray, measurement of electrical activities in different parts of the body by electrocardiograph, electro-encephalograph, electromyograph, etc., electronic recording of physiological functions of organs like heart, blood-vessels, lungs, etc., the biochemical estimation of body tissue and body fluid constituents, enzyme activity at cellular as well as molecular levels, and objective analysis and assessment of physical, chemical and electrical data by means of electronic computors, for diagnosing, prognosticating and even drawing up treatment schedules are revolutionising medicine in many ways.

Training in medicine has therefore to be modified not only in accordance with the changing patterns of bodily ills, but also with diagnostic and therapeutic appurtenances of the Space Age.

The old order has really changed giving place to new. The 'Horse and Baggy doctor' of the 19th century has given place to the specialist of the 20th century. Regional specialisation, organ specialisation and disease specialisation are the order of the day. Sciences are advancing in depth at a tremendous speed. Sky is no longer the limit. Astrological consultations with the stars and supersensory perception will be replaced by realistic physical contact with, and conquest of, space. Medicine has also to suffer a change into something rich and strange. Change is inevitable and inescapable.

The year two thousand might witness the above frightening changes. But it is within the bounds of possibility that another 1000 years hence the cycle of change may turn full circle particularly in regard to mice and men. I have referred in a preceding paragraph to the curve of evolution of medicine. If the same curvature is maintained the circle will be completed and medicine will come back to what it was, perhaps in A.D. 3000. So long as human biology remains the same, the concept of medicine as the study of human biology as a whole and not in parts will again be discovered and the humoral doctrine will have its rebirth with a new name and a new garb emphasising the paramount importance of the host in the mechanism of disease production and evolution.

If learning has to have meaning and purpose, newer methods for self-acquisition of knowledge by the student should be developed in such a manner that the postgraduate will not only gather further knowledge of his speciality but also develop his personality in the process.

The science of medicine is expanding in all the three dimensions. It is also expanding in the fourth dimension, keeping pace with the phenomenal success in the conquest of space. In A.D. 2000 the teacher may become much less important than now particularly for acquiring knowledge in depth. When knowledge has expanded to infinite dimensions, the teacher and the taught may be estimated as being equally far away from the goal by the mathematical statistician!

By A.D. 2000 more and more objectivity even in diagnosis and treatment will be brought about. The doctor may not even see and examine the patients. Answer to all problems will be given by the omniscient electronic computors. Investigational data will be fed into this 'Hampdonshire Wonder' of the 21st century and the patient will be given typed instructions regarding treatment in the matter of minutes if not seconds.

What then will be the status and scope of postgraduate medicine in A.D. 2000? Radiology will have advanced to such an extent that even cells and molecules may be photographed. Biochemical techniques will be so perfected as to provide accurate information regarding the slightest disturbances in the various metabolic, physiochemical and enzymatic activities even at the molecular level. Physiological functions of different organs will be accurately determined. Even the minutest structural changes will be made visible by means of ultra-electron-microscopes.

In order to penetrate such staggering depth of medical knowledge, the postgraduate student will be provided with such powerful aids that the teacher and the class-room can be dispensed with. Educational radio-hookup, television broadcasts, tape-recorded lectures and discussions, automation of libraries providing references and abstracts with push-button devices, contrivances to see, hear and examine patients without being seen or heard—all these and many more developments in audiovisual and perceptual appliances will relegate the teacher to the museum of archaeology. In those circumstances 'learning' will begin to have its real connotation.

If sciences including medicine continue to make progress at the phenomenal rate they have done during the past few decades, there may come a time when doctors will be dispensed with. The biochemist and the computing robot will jointly be able to diagnose, dispense and prognosticate with utmost objectivity, even without the assistance of a physician.

Will the medical profession wind up and disappear? No! Only the garb worn by the members of that fraternity will change. They will possess knowledge different from what we have. There will be many more specialists but of altogether different denominations. The present breed of Homo-sapiens, called doctors, is likely to undergo genetic transformation under the impact of new environments If one of us is suddenly transported to A.D. 2000 he will exclaim on meeting a brother specialist of that age: "Bless thee Bottom, bless thee, thou art translated indeed,"

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